Engineering and Mining Journal

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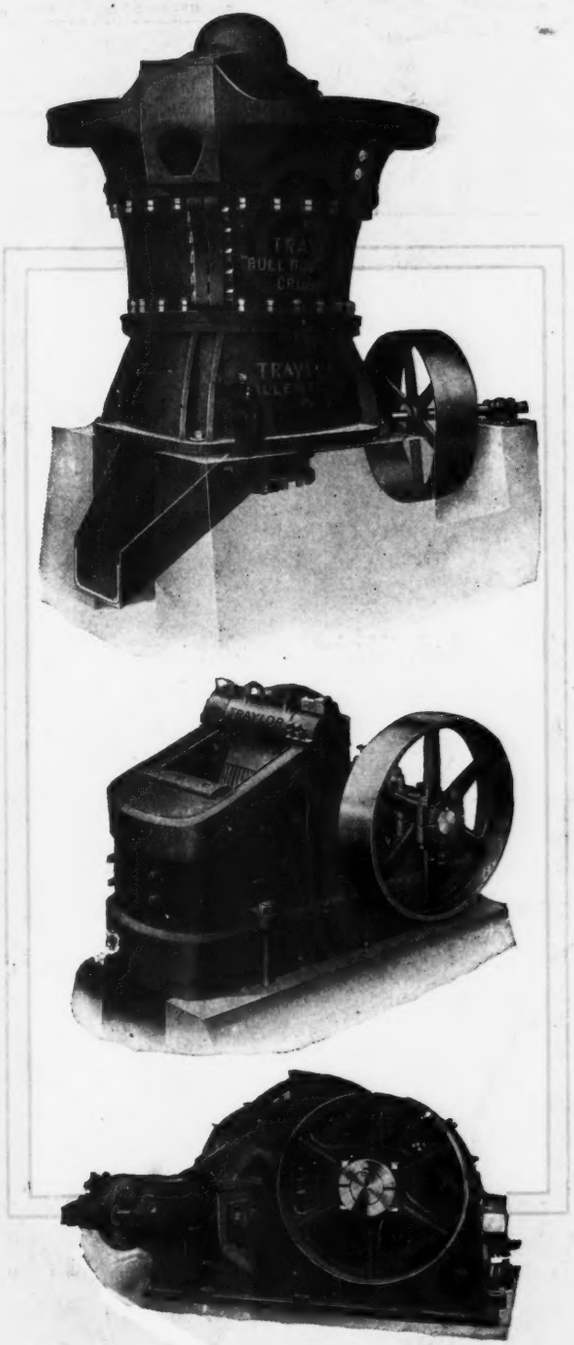

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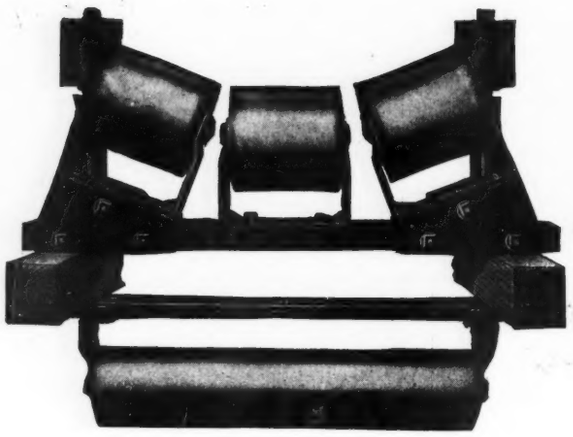

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Engineering and Mining Journal

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Mexico and Proposed Propaganda

IN RECENT news reports it is said that attempts are to be made to purchase the support of American newspapers for spreading Mexican propaganda in connection with a defence of Mexican policy toward American oil operators issued by General Candido Aguilar, son-in-law of President Carranza. It is a poor governmental policy which will not stand on its own legs and which requires the crutches of "propaganda" to enable it to limp along. Why is it that the real merit of a policy is not its best support? If the policy is fair, and if there exists confidence that it will be carried out substantially as it is stated, no propaganda should be required. The fact that propaganda should be thought necessary under the circumstances in itself arouses suspicion that there are defects either in the policy or in the way in which it is to be effectuated.

American oil operators and mining men ask few things from Mexico. Security of life and property, protection of titles, and the assurance that company operations can go on without onerous and unfair restrictions are necessary to promote continuity of work and to make the enterprises sufficiently remunerative to attract outside capital. In respect to taxes, all that is demanded is a square deal.

Non-fulfillment of these important conditions cannot be covered up by propaganda, however expensive or extensive that may be. Fulfillment of them will make unnecessary such a detestable method of evading direct issues. We want friendly and cordial relations with Mexico. American mining men have done their part, and require of Mexico only that she stabilizes conditions in a broad and equitable spirit.

There are important natural resources in Mexico. Their development will provide work and opportunity for the Mexican population as well as increasing the prosperity of that country as a whole. Without the assistance of foreign capital and the leadership of experienced technical men a long time must supervene before Mexico can come into its own. There is a mutuality of interest here which is the part of governmental acumen to recognize. Without an equitable division of the proceeds of enterprise there is little incentive for foreign capital to enter any country. A state of continual disorder and brigandage is also equally vexatious and embarassing to the government as well as to private enterprise.

Great courage has been shown by American mining men and oil operators in continuing operations in the face of danger and under trying experiences. How long are such conditions to continue? The answer to this question can be made in part by Mexico doing her share and, in part, by our own State Department insisting that Americans and American interests are accorded the treatment that foreigners should receive in any civilized country.

The Latest Transatlantic Flight

THE first dirigible to cross the Atlantic, the giant British R-34, arrived safely at Roosevelt Field, Long Island, Sunday, July 6, 1919, bearing a message from the King of England to the President of the United States. The craft was in the air 108 hours and 12 minutes, and covered a distance of 3,599 miles. It carried a crew of thirty officers and men. Major G. H. Scott, commander; Major Cook, navigator, and Lieutenant Harris, meteorological officer, gathered data relating to problems of aërial navigation, which further enrich the fund of knowledge already accumulated.

The distinguishing feature of this successful exploit is that the R-34 is the first lighter-than-air machine to cross the Atlantic. All previous attempts were with heavier-than-air types. The special advantages of each type, and which design will be adopted finally for commercial purposes, are for the future to determine. However, all recent attempts to cross the Atlantic in plane and dirigible add to the sum total of human knowledge of the art, and bring nearer the era of practicability of transoceanic flight.

This recent achievement of the engineer should prove a great boon to mankind, as it offers to all the world the advantages of an intimacy heretofore unknown. The British are to be congratulated on this latest historic achievement.

Re-employment at Calumet & Hecla

LAST May the Calumet & Hecla Mining Co. announced simultaneously an increased reduction of its operations and a changed form of curtailment. For some time previous to the announcement the men had been employed on three-fourths time at a reduction from war wages, but the plan was not sufficient to accomplish the necessary reduction of output and expense, so that a 50 per cent curtailment was ordered, and the men retained were allowed to work full time.

There was ample reason for the change. There was little or no market for copper, the active and profitable war demand for the metal lapsed with the signing of the armistice, and the accumulation of stocks, which were produced in many instances at costs higher than the selling price of that date, continued to grow. Up to that time, the companies had maintained their production, not because it was to their advantage to do so, but to aid constructively in the solving of a difficult labor situation.

There can be little doubt as to the magnanimity of this policy. Obviously, the greatest return for the company during that period could have been obtained by a drastic curtailment immediately following the declaration of the armistice. The plan followed, however, is indicative of the far-seeing vision of the Calumet & Hecla management, and it is such policies as these that

greatly aid in the stabilization of industry and the prevention of labor unrest.

The announcement made on July 7 by the Calumet & Hecla and subsidiary mines to the effect that all underground men are to be re-employed is indeed welcome news, not only in the local field but to the copper industry at large. The additional labor may produce no immediate effect in the amount of copper produced, and aside from the present possible anticipation of an immediate increase in the price and sales of the metal, there is now assurance that underground development work is to continue apace. Production during the war years proceeded at high speed, and in many cases little attempt was made toward the development of future supplies of copper. With the cessation of a pressing demand for the metal and the accumulation of stocks, the copper industry may be considered to be facing a breathing spell, and the news that this interim is to be used for the development of future resources is of significant interest.

Development in Dressing Tin Ores

IT WOULD seem, in view of the long time during which tin ores have been successfully treated in Cornwall, that there could be little room for improvement either in appliances or in the method of using them. The exceeding fine state of subdivision of the cassiterite has made it obligatory upon the tin-mining industry to perfect methods for the separation of the cassiterite from the slimes. This has been the real problem, as the coarser particles of the mineral admit of ready and clean separation from the gangue.

Modern research does not accept prevailing practice unless experimental verification has shown justification for it. Undertaken in this spirit, there is much that can be done in determining the best procedure to be followed in any one case, and there are few instances where improvement cannot be made. In a series of papers presented before the Institution of Mining and Metallurgy, Professor S. J. Truscott has given the results of investigations made by him in collaboration with J. H. Goodchild, K. S. Low, and H. L. Burnie upon the treatment of slimes on Cornish frames. It is reasonable to assume that the limitations of this simple device had been determined long ago, but Mr. Truscott and his collaborators have shown that radical improvements are possible and that better results can be achieved.

The nature of the surface of the frame, its length and inclination, as well as washing, rate of feed, consistency and duration of feed, have been subjected to exhaustive investigation. The value of re-grinding not only the middling product but also the sand product, which has been allowed to go to waste, has been demonstrated. Tailing losses have been due not so much to excessive comminution as to the excessive state of subdivision of the cassiterite. If higher recoveries are to be made, the re-grinding of the sand has been shown to be essential.

The rapid enrichment of the slime by the use of the simple frame, improved as shown by the experiments, removes the danger of greater tailing losses on account of the finer grinding. Higher recoveries necessarily imply a corresponding increase in the proportion of liberated grains. In this respect the tin ores present a problem of greater difficulty than is met in other ores where the mineral grains are of larger size and the fine grinding is of lesser degree. The results of the investigation as a whole are of importance to the tin industry, as well as marking an advance in improving some of the simpler methods of treating slime, and commendation is due Mr. Truscott and his collaborators for their thorough work.

The Situation In Butte

BUTTE is again afflicted with labor troubles. The desire to strike is apparently like an intermittent fever, which comes and goes with the changing condition of the patient. No longer ago than February mining was practically suspended in the district for a short time, following a wage reduction at the Great Falls and Anaconda smelteries. Now again a strike is pending, some of the men having already gone out.

On Sunday last, the downtown pay office of the Anaconda company was dynamited, supposedly by a fanatic. Whatever the justice of their cause, violence will do the workmen little good. Nothing can be gained thereby that cannot be had by peaceful conference. Whether the deed of an individual or not, a criminal act will inevitably be charged against unions in general by the public. The organization in Butte will do well to help rid the district of such radicals.

A Brighter Future For Zinc

TO MAINTAIN an industry—for example, the zinc industry—the demand for the product must be maintained under price conditions that permit the producer to make a fair profit. Maintaining demand for a product means convincing the consumers that they need the product, and can use it to their advantage. If customary uses for the metal are insufficient to sustain the demand, new uses must be found, and consumers must be educated to appreciate the advantages of these new uses.

A campaign to educate consumers to new uses for zinc should be founded on scientific study, research, experiment, and demonstration, followed by advertising. This is one of the constructive ideas expressed by Pope Yeatman in his address before the American Zinc Institute of St. Louis on June 9, published on page 19 in the last issue of the *Journal*. Mr. Yeatman points out the development of the spirit of helpful co-operation among zinc producers and a better understanding between miners and smelters.

The conversion of a blind feeling of antagonism into a mutual desire to serve has never failed to produce good results. Perhaps here is a lesson for other ill-advised opposing interests in industry.

Colombia To Get $25,000,000

THE Foreign Relations Committee has reported, or is about to report, a new treaty giving to Colombia $25,000,000, but making no apology for the assistance given Panama 16 years ago. There is a strong probability that this treaty will be ratified and its terms carried out. The payment of this sum has been recommended by two Presidents of the United States, and probably it would have been made long ago had it not been for the strenuous opposition of Theodore Roose-

velt. Ex-President Roosevelt remembered well the reasons for the failure of Colombia to ratify an earlier treaty and felt strongly that the United States had not only acted legally but justly, and he naturally opposed what would appear to be a reflection on his administration.

The question of who was right or who was wrong will probably not be discussed at length on this occasion. Sentiment seems to be in favor of the payment being made, and we trust that the money will be accepted in as good a spirit as it is tendered. If the funds are used, as has been intended, for internal improvements, and if they will heal a wound that many Colombians have felt was unjustly inflicted, we need not regret the manner of closing the incident.

Perhaps a more intimate acquaintance between Colombia and the United States may develop from this settlement. There is reason for such acquaintance to grow. Colombia needs much that we can supply in the way of manufactured articles, and she has natural resources with which to pay for what we can send her. Her chocolate, beans, and coffee are of the finest quality, but what is of more interest to the miner is that her mineral resources are extensive and of considerable importance.

Looking back over the statistics of mineral production it will be seen that there was a time not so long ago when Colombia had more gold credited to her than had the United States. Her rivers and streams have produced a large quantity of platinum. Her silver production has been large, and she is now practically the only producer of emeralds in the world. On account of inadequate means of transportation, and lack of fuel development, the base metals of Colombia have attracted little attention.

For the immediate future gold, silver, and platinum mining offer more attractive opportunities than other metals, and we believe that Colombia will not go unanswered if she applies to the miners of the United States for assistance in the development of these precious metals.

From time to time in the past we have published descriptions of mining districts in Colombia, and our readers will find in the files of the *Journal* an immense amount of information respecting this fascinating country. Though we have published much, there are many attractive areas of which nothing or but little has been written, areas that are well worth the serious attention of the mining industry, and we believe, as the years go by, and our miners come to know Colombia better, that they will find it an extremely interesting and profitable country in which to operate.

Too Much Legislation

ON PAGE 49 in this issue our Denver correspondent discusses the Engineers' License Bill, recently passed by the Legislature of Colorado. This bill requires that all engineers practicing in the State of Colorado must take out a license before they can legally undertake any engineering work. As our correspondent points out, the conditions under which a mining or other engineer is employed are markedly different from those of the physician. Consulting mining engineers may be called by their clients to undertake examinations and investigations in any part of the United States or in foreign countries. In the course of a year a mining engineer might visit a dozen states and several foreign countries. Can anyone imagine a more exasperating condition than for such an engineer to be compelled to take out a license in every state which he may enter in the course of his activities?

Most mining engineers engaged in consulting practice have their offices in large cities where they can be conveniently reached by their clients. If other states follow Colorado in the enactment of such legislation, an engineer with a large practice would be compelled to take out licenses in those states where his business centers. We hope that no other state will be so short-sighted as to emulate the example set by Colorado. The motive back of this law is clearly an attempt to monopolize local engineering practice, for the aggregate revenue to be derived from the operation of such a law will be pitifully small compared with the loss in prestige of the state enforcing it. Colorado mining interests require and should receive protection from unwise legislation of this kind.

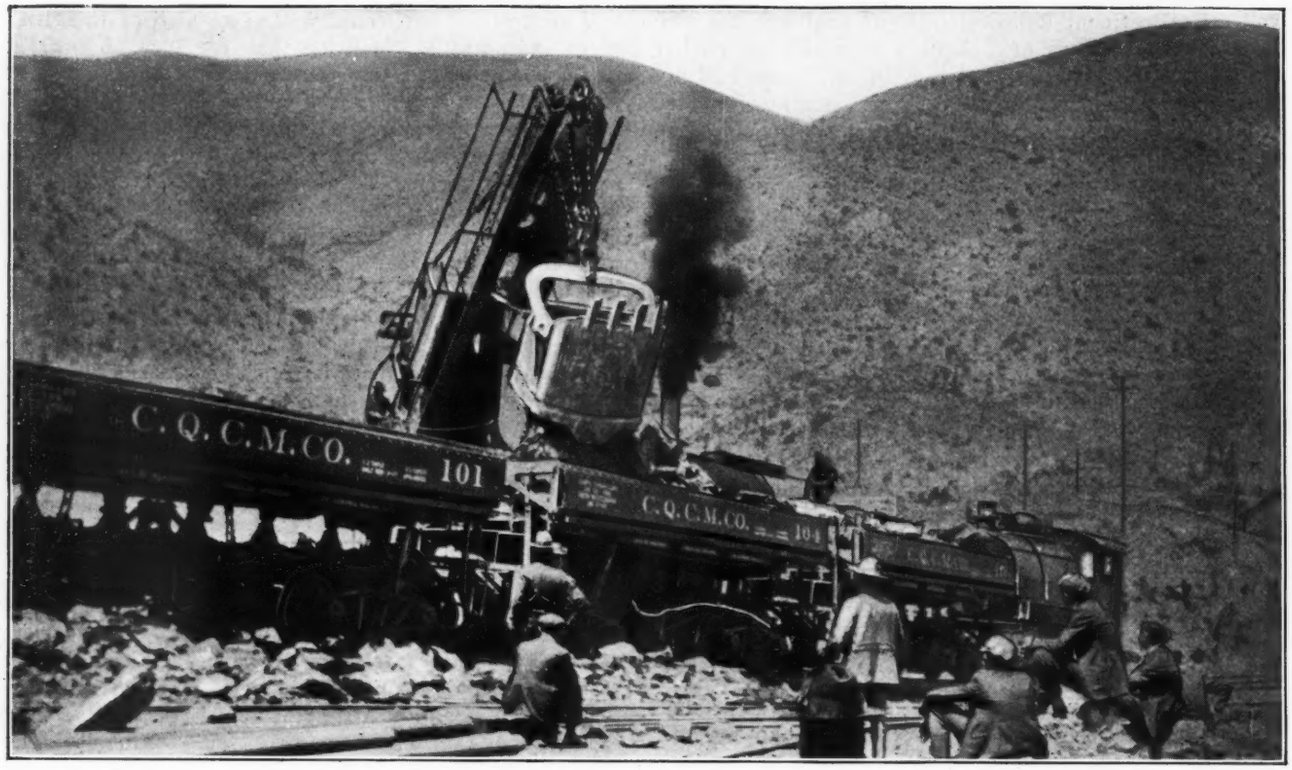
The Geologist and Prospecting

THE location of mineral deposits at grass roots must grow more infrequent from year to year, especially in those areas that have become the home or hunting ground of intelligent men. Much virgin territory remains, and it will be many generations before the most distant has been prospected. But it is not upon these distant localities that our industries must depend. Manufacturing industries do not quickly follow to the source of raw supplies. Supplies must be brought to industrial centers, and the nearer those supplies are to the industrial centers already built the more valuable do they become. Naturally, supplies close at hand will be the first to be exhausted, and gradually the manufacturer draws from known sources farther and farther away, until the expense of transportation becomes so great as to threaten the industry. It is at this stage that the prospector loses his importance, and the economic geologist has an opportunity to exhibit his skill. With all visible ore exhausted, it is no longer a question of following stringers and indications to other veins or bodies of mineral, searching with small deposits as a guide to larger ones, but is a a matter requiring an intimate knowledge of ore deposits and the formations in which they occur.

The surface of the earth, that portion of it which a prospector may examine with care, is a very limited portion of the whole. The surface of the earth as known to the geologist, or that portion respecting which he has considerable knowledge, may extend from daylight to several miles in depth, certainly far beyond human means of penetrating with shafts or boreholes.

It is in the study of these buried formations and the minerals that they contain that the geologist becomes especially useful to industry. The geologist is not infallible, he is not working with an exact science, or not with one whose factors are all known. The most that he can do is to guide, to reduce the amount of useless risk and increase the amount of profitable work.

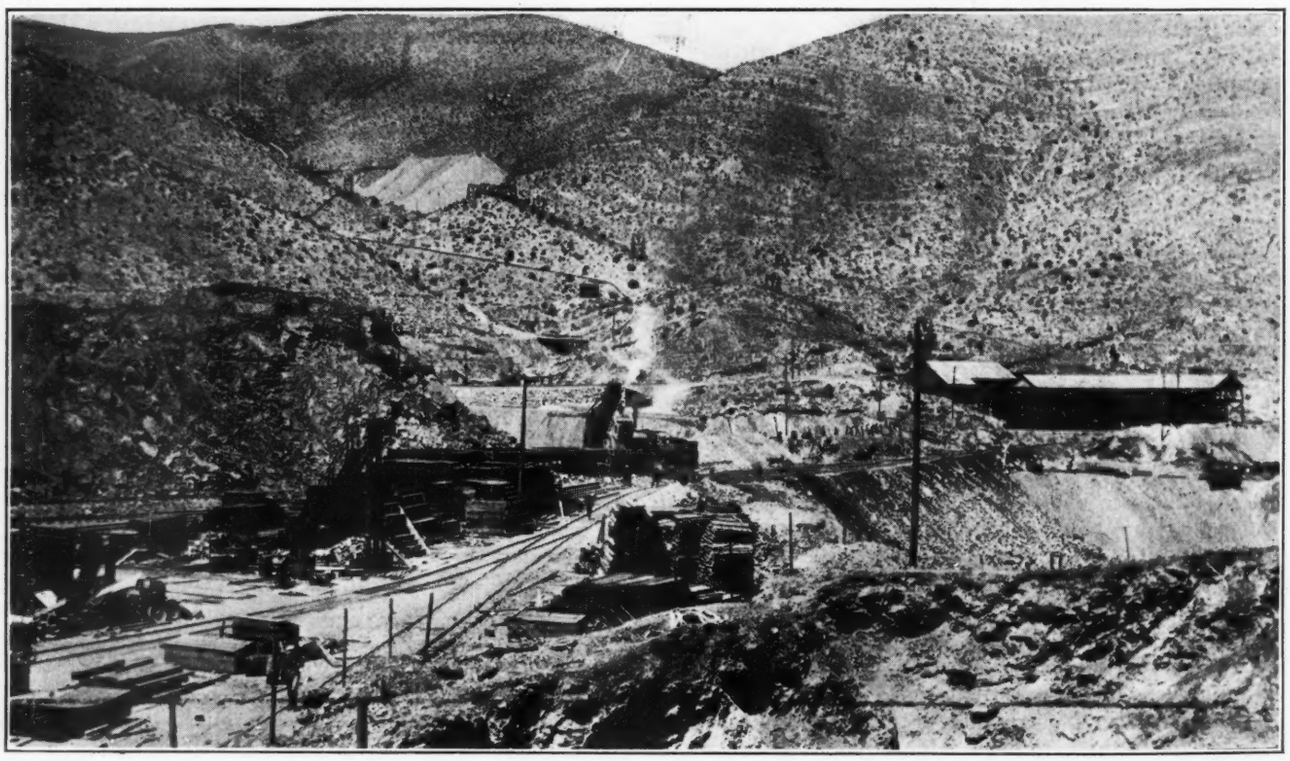
Not only in oil but in the mining of almost every mineral of economic importance geological knowledge may be used to advantage. Our mining schools of the future will probably spend as much time in teaching how to use geological knowledge as they spend in teaching pure science, and as we now have mining, metallurgical, and chemical engineers, our colleges will soon be graduating geological engineers.



STRIPPING OPERATIONS OF COPPER QUEEN CONSOLIDATED MINING COMPANY AT BISBEE, ARIZONA. STEAM SHOVEL LOADING INTO 20-YD. AUTOMATIC AIR-DUMP CARS

Mining Operations in Arizona

VIEW OF COPPER QUEEN COMPANY'S OPERATIONS AT BISBEE, ARIZONA



Electric Blasting Equipment

Dependability and Conditions Under Which Electric Detonating Caps Can Best Be Used—Methods of Testing—Advantages in the Use Of the Ohm-Meter

BY L. D. ROWELL
Captain of Engineers, Washington, D. C.

THE experience of the Army in the recent European War brought out certain weaknesses and faults in the equipment used in electric blasting, and led to the development of apparatus which, it is hoped, will find a permanent place in the commercial field. It is not the purpose of this article to discuss the method of setting off blasts in general, but to present certain features of the problem as it affects general practice in the use of electricity for the detonation of explosives.

The standard electric caps manufactured in this country are thoroughly dependable if handled with intelligence, and, when one considers their construction, their uniformity is remarkable. The "bridge" of an electric cap is a piece of high-resistance alloy not over $\frac{1}{8}$-in. long, and so fine that it can hardly be seen with the naked eye. The resistance of this bridge is about one ohm. It is soldered to the ends of the copper wires which are sealed into the cap and serve to connect it in the circuit. To fire the cap, the bridge must be heated by a current of electricity to the temperature necessary to start detonation of the fulminate, which is materially less than that required to fuse the wire of the bridge. A current of 0.4 amp. will fire some caps, and 0.5 amp. may be depended upon to fire any single cap. The time required to produce detonation, however, varies from 0.05 sec. to 0.2 sec., even with caps of the same resistance, and may vary considerably more. This fact is of the utmost importance in electric blasting, as will be shown later.

The variation in time required for detonation at low current strengths is not due to avoidable variations in manufacture. It is probably dependent on the amount of solder at the joints where the bridge wire is soldered to the leading-in wires, to the character of the joint, and to the closeness of contact between the bridge wire and the fulminate paste which surrounds it. There is no way of testing for variations of this kind, other than by exploding the cap, and the whole structure is so minute that no inspection could possibly detect it. It does not detract in the slightest from the dependability of the cap, provided the condition is clearly understood and proper precautions are taken to insure the necessary current in firing. Unless the caps have been injured by storage in too hot a temperature, failures may always be charged to a faulty circuit or too low current strengths when firing.

The effect of time variation at low currents is seen only when two or more caps are connected in series. If a current of one-half ampere be used, and two caps be connected in series, it is probable that one of the caps will fire and open the circuit before the other has reached the firing temperature, and if a circuit of 20 or 30 caps be connected up, a current of one-half ampere may fire only a few caps for this reason, even though the same current, if continued, would have fired all of them. The conclusion that the unexploded caps are faulty is entirely wrong, and is based on a lack of knowledge of the true conditions.

The difficulty presented by this time variation can be overcome only by using a current so high that the slowest cap in the circuit will be raised to the firing temperature before the quickest cap explodes and opens the circuit. A time interval elapses between the raising of the bridge wire to the firing temperature and the explosion, probably due to the transfer of the necessary heat from the wire to the fulminate. While this is taking place in the "quickest" cap, the current must be high enough so that the bridge of the "slowest" cap reaches firing temperature. The explosion of the first cap, and consequent interruption of current, will then not interfere with the firing of the second, as the heat transfer, which takes place in a few hundredths of a second, can proceed after the current has been interrupted.

So far as I know, no accurate determination has ever been made of the magnitude of the current required to ignite a number of caps. Experiments by Captain Ralph W. Crocker, Chemical Warfare Service, at the Pittsburgh Laboratories of the Bureau of Mines, show an increase of 20 per cent in the current necessary to fire two caps in series, one of which was 10 per cent high in resistance and one 10 per cent low. An increase of 8 per cent in current over that for single caps was found necessary where two caps of the same resistance were connected in series.

From results secured in the testing of blasting machines, I believe one ampere may be accepted as a safe current to insure the detonation of all caps in series. As the heating varies as the square of the current, this represents four times the heating rate required for single caps. The bridge wire fuses before explosion of the cap at a current of about 2.5 amps., and this value forms the basis of the specifications adopted by the Corps of Engineers, U. S. Army, for electric exploders.

TESTING BLASTING MACHINES

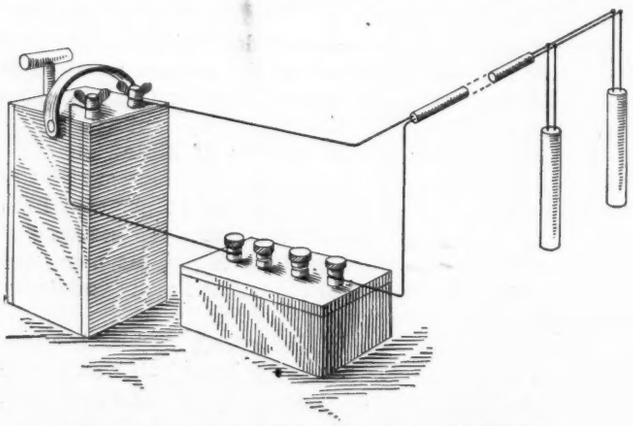
The considerations mentioned are of the utmost importance in the testing of electric blasting machines. It is customary to test the machines by the use of a rheostat (which takes the place of a stated number of caps in the circuit), with a single cap connected in series with it. Such a test, however, may give erroneous results, for the reasons already stated; that is, the current necessary to fire a series of caps is always higher than that which will always fire a single cap. To remedy this, and provide the necessary factor of safety, the resistance of the rheostat is made two or three times that of the caps which it replaces, but this may not give the desired results, as will be shown.

The type of blasting machine in most common use delivers an initial current which is determined by the windings of the machine, and is independent of the number of caps in the circuit. Now, if such a machine

is designed to deliver an initial current of one-half ampere or slightly higher, it will pass a splendid rheostat test, but it will not fire a series of caps with any degree of certainty. The effect of added resistance in the circuit is to produce a more rapid falling off of current, so that a machine designed to deliver an initial current of five amperes may fail on the same rheostat test, and still be a dependable machine, up to its rating, though the first machine is not dependable at any rating. Making the rheostat resistance double that of the caps in the contingency suggested has not provided the necessary factor of safety. It can also be shown that, with the five-ampere machine, doubling the resistance and using a single cap may not provide a true indication of the machine's capacity.

Rheostat Test

The best rheostat test is to connect two caps in parallel, as shown in the figure. If they both fire, the test shows that sufficient current is delivered to insure the firing of all the caps in a series circuit. The factor of safety in such a test conforms to actual working conditions, and though a difference in the resistance of the two caps may permit the explosion of both caps on less than one ampere, my experience warrants the belief that this is a reliable test for capacity. In making this test, be careful to place the caps so that one cannot detonate the other. The rheostat in this case should be equivalent to the actual resistance of the caps which it replaces in the circuit.



METHOD OF TESTING BLASTING MACHINE

The average resistance of a Du Pont cap with 10-ft. leads is 1.3 ohms, and if 1.5 ohms per cap is used in the rheostat it allows for the resistance of the cap and connections, when properly made. Duplex firing wire has a resistance of one-half ohm per 100 ft., or 300 ft. is equivalent to one cap. Allowance for this should be made in calculating the number of caps in the circuit. Thus, 25 caps connected up through 1200 ft. of duplex firing wire would be equivalent to 29 caps. The Du Pont rheostats have a resistance of about 3.2 ohms per cap; when used as described above, with two caps in parallel, their rating may be increased in the ratio of 2 to 1. Thus a machine which fires two caps in parallel through the 25-cap step of a Du Pont rheostat would have a capacity of 50 caps.

The blasting machines in common use are frequently referred to as magnetos, or magneto exploders. This is a misnomer, and the term should not be used, inasmuch as it conveys a wrong impression as to the nature of the machine. These machines are electric generators of the series type; that is, the field windings are in series with the cap circuit. When such a machine is operated with no connected circuit, severe insulation strains are produced, and in the larger capacities this becomes a vital defect. The shunt machines, however, in which the field windings are connected in parallel with the cap circuit, do not have this objectionable feature, and they may be designed for larger capacities than is practical in the series machine. The Du Pont No. 6 is an example of this type.

By the use of small, enclosed-frame machines, with impregnated windings, exploders having considerably greater capacities than those in present use have been built and tested. Machines having the size and weight of a 30-cap exploder have a capacity of 120 to 150 caps, and a machine having a capacity of 500 caps weighs not over 35 lb. and is entirely practical. These machines represent a development in advance of any of the earlier machines, and indicate the possibilities in this field.

Testing of the electric-cap circuit is usually of the crudest sort, consisting of a test for continuity made with a "circuit detector," which is some form of galvanometer, with a self-contained silver chloride cell. This type of cell is used because its potential is so low that it does not give enough current to explode the cap, and also because of its supposed permanency. This latter quality, however, is questionable, and there is nothing more undependable than a cheap circuit detector equipped with a silver chloride cell.

The best instrument of this type is a well made, pivoted galvanometer, with a graduated scale. With a good cell, and careful usage, such an instrument serves the purpose of tests for continuity of the circuit, and gives a rough indication of the number of caps. Instruments of the annunciator type, which merely show whether the circuit is open or closed, are not recommended.

For military operations, and for commercial work where it is important that there shall be no failures in the explosion, especially in cases where the cap circuit is connected up for some time before being detonated, it is highly desirable to make more thorough tests than those above indicated. For this work an extremely rugged, portable ohm-meter has been developed, by means of which the resistance of the circuit can be instantly measured, with an accuracy sufficient to detect the shorting-out of a single cap. With it, tests for opens, short-circuits and grounds can be made readily. As it uses an ordinary flash-light cell, which is easily renewable, it is not subject to the uncertainty of instruments using silver chloride cells. Protection against currents high enough to explode the caps is secured by a resistance combination, and the sensitiveness of the instrument is such that the actual current used is less than that of the ordinary circuit detector, being limited to 2 per cent of that required to explode the cap. With such an instrument, the condition of the cap circuit may be fully determined at any time, and the development of trouble at once detected.

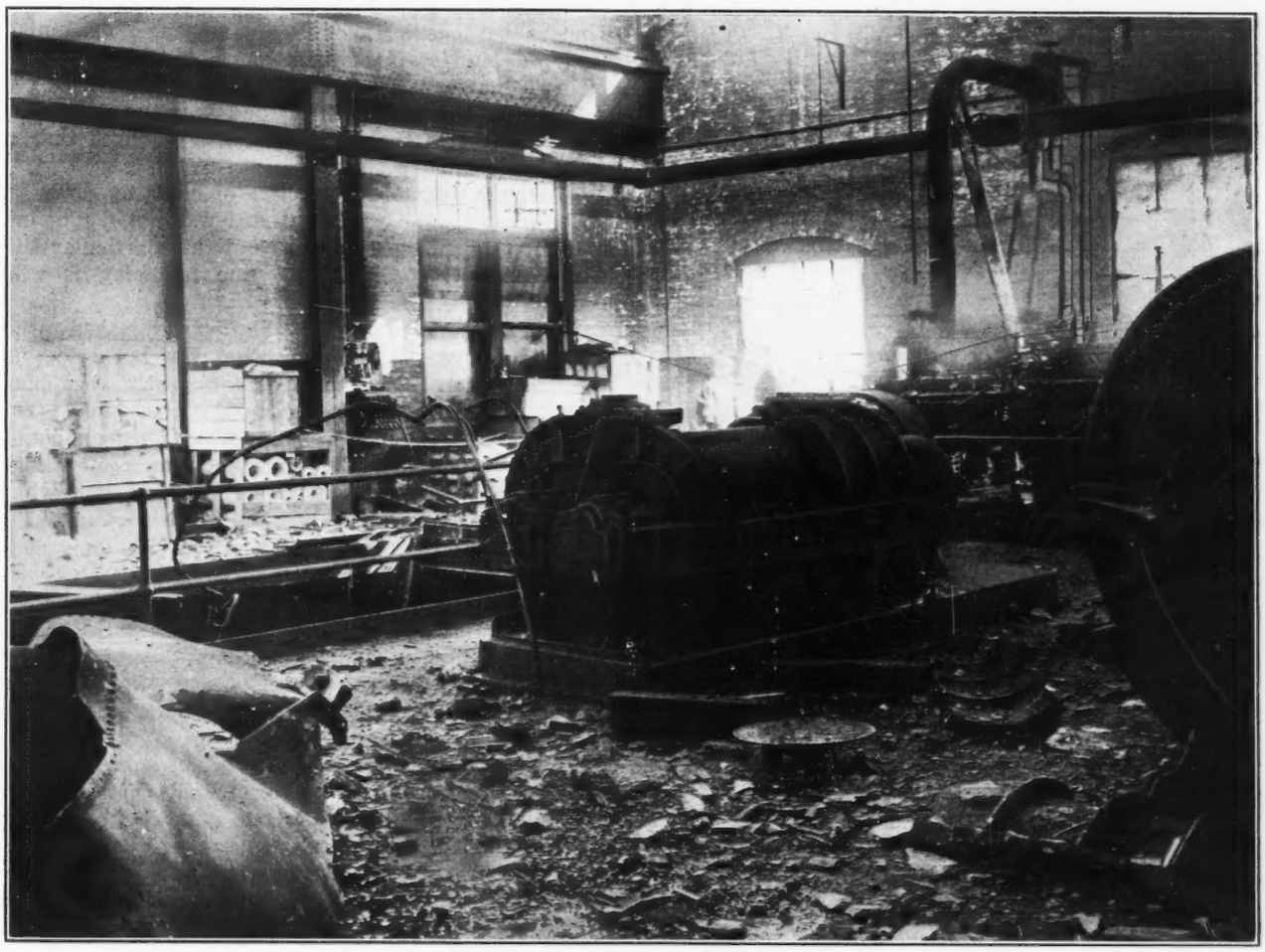
Exports of Graphite from Madagascar during the first nine months of 1918 amounted to 15,914 metric tons, according to a recent consular report. The figure for the corresponding period of 1917 is not at hand, but, during the whole of that year, exports amounted to 27,838 metric tons.

Blast-Furnace Explosions

A Disastrous Accident Occurred When the Blowing Engine Was Shut Down, Probably Due To Leaky Jacket Permitting Contact of Water and Hot Coke, and Consequent Generation of Water Gas

BY B. B. HOOD
Assistant to Superintendent, Chrome Plant, United States Metals Refining Co.

IN SHUTTING down a copper blast furnace precautions must be taken to avoid accidents. These precautions should, among other things, guard against the gas generated in the furnace getting back into confined spaces, where it might explode and cause damage. Several years ago at the Chrome, N. J., plant of the United States Metals Refining Co. a serious explosion took place, an account of which may be of value in helping someone to protect his plant against a similar calamity.



WRECK OF ENGINE ROOM CAUSED BY EXPLOSION OF GAS IN AIR-BLAST PIPE

The equipment consisted of two blast furnaces, 44 by 186 in. An air pipe, 32 in. in diameter and about 300 ft. long, connected the two furnaces with the blowing machinery. This air pipe, as it entered the smeltery building, branched to each furnace and was fitted at the end with a gate valve. The two branch pipes to the furnaces were each fitted with valves, one being a butterfly and the other a gate valve. Under normal operations the valve at the end of the blast pipe was closed and the two valves on the branch pipes were open.

The blowing machinery consisted of a No. 9 Roots blower, directly connected to a reciprocating steam engine. An auxiliary motor-driven No. 6 Roots blower of much smaller capacity was also connected to the air pipe. The power house building is 52 by 126 ft. in size, of brick construction, and houses, besides the two blowers mentioned, a converter-blowing engine and two high-pressure air compressors. All of these engines were furnished with steam from a boiler plant 150 ft. distant.

The blast-furnace blowing engine was to be shut down in order to repair the crosshead and connecting rod, which would take about ten minutes. The motor-driven blower was not running, nor was it started up. The smeltery was notified that it was desirable to shut this engine down, and the management put the furnaces in

first-class condition and reported back to the engine room force that everything was arranged for the short shutdown. The blower was then stopped. The furnaces still contained their usual charges, and precaution was taken to remove about one-third of the tuyere blocks on each furnace. The two valves on the branch air lines were not closed. This operation had been performed many times before, both with the branch line valves closed and with the valves open.

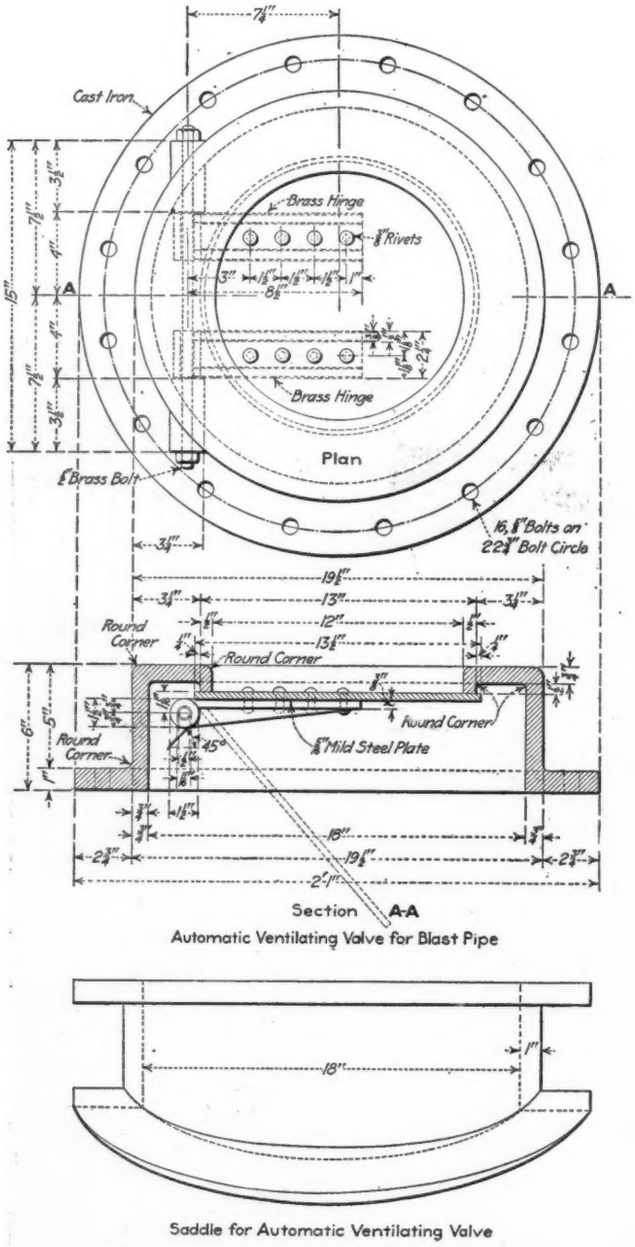


FIG. 1. DETAILS OF VENTILATING DOOR

Approximately four minutes after shutting the engine down a slight explosion took place, which rattled the safety valve mechanism in the power plant. About a minute after that a terrific explosion followed. There were five men in the building at the time of the explosion, and that no one was killed is a miracle. The two Roots blowers were completely wrecked, as indicated by the photograph, and pieces of them weighing from 200 to 300 lb. were scattered from one end of the building to the other. One piece went through the roof; another piece went through a 12-in. brick wall. All of the window sashes and frames and door frames were completely wrecked. The roof of the building was made of tile, and large parts of it had to be replaced, as the tile seems to have been lifted up from the purlins and then dropped back into place again. Flying pieces of metal broke the main steam lines, and the building rapidly filled with steam. The men groped their way out, some of them hardly knowing how they arrived outside of the building. Aside from a few bruises and the general scare, the men were none the worse for their experience.

The engine driving the large Roots blower was thrown out of line to some extent, but otherwise not damaged. The valve mechanism of the converter-blowing engine was partly wrecked, but the two high-pressure air compressors escaped with little injury. The 32-in. air line had a "T" connection just outside of the engine room, one end of which was covered by a blank flange $\frac{5}{16}$ in. in thickness. This was blown off, striking a steel tank 4 ft. in diameter and 10 ft. high and knocking it over. One of the $\frac{3}{4}$-in. bolts was hurled a distance of about 100 ft. through an erecting shop and through a window of a machine shop, barely missing a machinist's head, and burying itself in the opposite wall. The gate valve at the smeltery end of the 32-in. blast pipe consisted of a slide $\frac{1}{4}$ in. thick, and was not even bent. In fact, those in the smeltery hardly realized that an explosion had taken place.

As stated before, the practice of shutting down the blowing engine for a short period was not a new one. and why an explosion took place at this particular time is not absolutely certain, but the following is what probably happened:

One of the jackets of one of the furnaces leaked rather badly. The water, upon meeting the hot coke, undoubtedly generated water gas in sufficiently large quantities to force its way back into the blast pipe. This took place until the pipe was practically filled completely back to the engine room, and then, for some reason or other, it was ignited, causing the slight puff which had rattled the safety valves near the blowers. The mixture in the pipe, however, was too rich to explode, but a flame gradually burned its way back along the pipe until it neared the power-house end of the gas column, where undoubtedly air was mixed with the gas, forming an explosive compound. This was ignited, causing the explosion close to the boilers themselves. There was absolutely nothing in the power house to ignite the gases.

The smelting plant was in operation again in three weeks, during which time a No. 11 Roots blower weighing about 67 tons was taken from a similar plant near Salt Lake, Utah, shipped east by express and installed. No other blower of similar capacity could be obtained in less than two or three months' time. New air-pipe connections were made, the blower engine was relined, the foundations were enlarged to suit the larger blower, and the two blast furnaces were practically rebuilt, as they were in need of extensive repairs. The repairing of the damage done by this explosion might properly be listed among the historical quick repairs.

The total cost of the explosion is not represented entirely by the repair costs; the lost production which might have been made in that time must be considered.

To protect the plant against explosions of this nature in the future there have been installed upon the main blast pipe seven ventilating doors (Fig. 1). These are

nothing more than check valves 12 in. in diameter, and are situated along the top of the blast pipe. They automatically open to the atmosphere when the pressure inside of the pipe is taken off. The air volume is such that they automatically close themselves when the blowing engine is started up. The purpose in installing these valves is to allow the gas, when produced, to find its way out to the atmosphere before collecting in large enough quantities to do damage. Care is also exercised to see that valves on the branch blast pipe lines at the furnaces are closed when the blast is taken off.

Engineers' License Bill

Act Passed by Colorado Legislature Providing for Licensing of Engineers Takes Majority Of Engineers by Surprise

DENVER CORRESPONDENCE

ENGINEERS who intend to engage in professional work in Colorado will be interested in the Engineers' License Bill. When Senate Bill 339, introduced by Senator Knaus and Mr. Finley, providing for a State Board of Engineer Examiners and the licensing of engineers in the State of Colorado, became a law, fully 90 per cent of the practicing engineers of the state were surprised. Most of them had never heard of the bill. A few who were in touch with activities in the Legislature knew that such a bill had been offered, but they regarded it as freak legislation and assumed that it would in all probability expire without receiving serious consideration. However, before the majority of the engineers who were to be affected by the measure had become familiar with it, the bill was passed.

Supporters of the bill claim that the licensing of engineers is a desirable reform measure to protect the public against incompetent advice, and at the same time to reduce competition among engineers. These supporters of the measure, representing a small percentage of the practicing engineers of the state, regard the licensing of engineers as similar to the licensing of physicians. This view indicates that they fail to appreciate that the services rendered by physicians and engineers are far from parallel in most respects.

Whenever a man engages the services of a physician with whom he is unacquainted, it is because an emergency exists and human life may be endangered by delay. It is proper that the law should provide for such cases, as well as it can, by insisting that a practicing physician give evidence of certain ability. On the other hand, when a man desires engineering advice, no such emergency exists as in a case requiring the immediate services of a physician or surgeon. A client rarely engages an engineer with whom he is unacquainted, or who has not been satisfactorily introduced and recommended. Engineers are not selected hastily from the lists in business and telephone directories. Competent practicing engineers receive their appointments through the recommendation of satisfied clients; they fear no competition from incompetent or inexperienced members of the profession, nor is the public safety ever endangered through their work.

There are serious and well-founded objections to the bill from the point of view of all engineers who reside outside the state. Under the law, all consulting engineers, including those engaged in the investigation of mining and metallurgical projects and those who may be directly or indirectly instrumental in bringing outside capital into the State of Colorado for its industrial development, may be subjected to the irritation and delay incident to making application for a license and passing an examination before they may proceed.

Regardless of the high personal qualifications which individual members of the Board of Engineer Examiners may have, such a board will be utterly incompetent to pass upon the ability of a certain engineer to render certain specific service to his client. As a rule, the client will have no interest whatever in the opinion of the examining board, because confidence in his engineer may have been firmly established by previous service or satisfactory recommendation. In instances of this character, which represent a large percentage of all those coming under the law, the examining board will serve no useful purpose, but the operation of the law will make Colorado unpopular with engineers and hamper development with red tape.

The law provides that the Examining Board shall admit to examination any candidate who pays a fee of $10 and submits evidence, verified by oath and satisfactory to the board, that he is a citizen of the United States and is more than 25 years of age; that he is of good moral character; and that he has been actively engaged in the practice of engineering for at least six years, in the employ or under the supervision, direction, and tuition of one or more practicing engineers.

Each complete year as a student in an engineering school of recognized reputation, or employed in the military service of the United States or its Allies during the war, shall be credited as one year of practice. The candidate must show that, during two years of his period of six years of active practice, he has been in active, responsible charge of engineering work requiring the exercise of initiative, judgment, and independent decision. The Board of Examiners shall verify the statements of the applicant, so far as practicable, and shall mail to each licensed engineer and to each employer or reference given by the applicant a copy of the statement pertaining to his experience. In not less than 60 nor more than 120 days, the application for license shall be either approved or denied, and final action taken thereon.

The law provides the manner in which the examination of candidates shall be held. Upon the evidence of the official record that an applicant has successfully passed the examination, the Board of Examiners shall issue to him a license to practice engineering, upon the payment of an additional fee of $5. This fee, added to the examination fee of $10, makes the total cost of a license amount to $15. This license may be renewed from year to year by paying an annual fee of $5.

The following extract from the law is of interest; "Any person who, not being then lawfully authorized to practice engineering within this state, according to the provisions of this act, shall attempt to practice or shall so practice for hire, and any person who shall, in connection with his name, use any designation tending to imply that he is a licensed engineer, within the meaning of this act, and any person who shall violate any other provision of this act, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be punished by a fine of not more than $500 or by imprisonment for not more than six months, or both.

Refining Flake Graphite for Crucible Use*

The U. S. Bureau of Mines Investigates the Possibilities of Producing a Satisfactory Grade of Crucible Graphite From Alabama Flake Graphite—Intermountain Station Contributes Research Results

BY FREDERICK G. MOSES

FERGUSON[1] describes the requirements for crucible graphite as follows: "Graphite for the making of crucibles must be of great purity. Its content of graphite carbon should exceed 85 per cent and preferably should be as high as 90, and it must be practically free from mica, pyrite, and iron oxide. A small amount of quartz is not injurious. Graphite for making crucibles should also be coarse enough for the interlocking fragments to be bound by the clay with which it is mixed. It should contain a large percentage of flake about 1 m. in diameter and should all remain on a 100-mesh screen."

The concentrates produced in the Alabama district differ widely in their physical characteristics and graphitic content. Notwithstanding this fact, however, the physical properties of the different minerals composing the concentrates cannot, of course, vary greatly, and hence a scheme worked out for any one of the types can be applied, with only slight variations and adjustments, to the others. For this reason, and because of the numerous schemes tried in the limited time available for the investigations, it was impossible to do all of the work on all of them. It was decided, therefore, to select several of the most representative for investigation, and to determine the extent that the results obtained on the concentrates could be generalized and applied to all.

EXISTING REFINING METHODS

The present method of finishing the crude concentrate consists of, first, drying the concentrate from the previous process, grinding the dried material in a buhr mill, and "bolting" or screening the ground product to remove the impurities that have been crushed during the grinding operation. The theory of the process is that the graphite, being tougher, smoother, and thinner than the impurities that occur with it, will be rubbed and polished between the buhrstones, with a minimum reduction in size. The impurities, owing to their more brittle characteristics and more massive structure, will be ground between the stones to such an extent that they can be removed by screening over a suitable cloth.

It is readily understood that the theory of this process is simple, and in fact, within certain narrow limits and under favorable circumstances, the method will give good results. As a general rule, however, two difficulties are encountered that interfere with the commercial success of the operation. The first of these is the large proportion of the coarse and valuable flake that is often destroyed during the grinding. The second is lack of uniformity in the finished product. It is evident that the primary object of the present investigation is to determine the most efficient manner of obtaining the desired results and eliminating the troubles in the process mentioned above.

The first experiments were made to determine the possibility of separating the graphite and gangue material by differences in specific gravity and shape of the various particles. The apparatus first tried depends on the difference in specific gravity and the difference in shape of the various minerals to accomplish separation. This type of apparatus is already being used to a limited extent in Alabama, and is there known as an aspirator. The aspirator is fundamentally an air classifier. The name is appropriate, for the reason that the separation depends on the settling rate of the different minerals in a current of air.

The apparatus constructed for the experiments was closely similar to devices now used in the Alabama field. The material to be treated is fed from a hopper to a roller, from which it drops into the large end of a long, sloping, horizontally placed box. The roll feeder is arranged so as to feed the material in an even curtain across the whole opening. Leading from the small end of the box is a suction pipe equipped with a suction fan. The box is 13.5 in. wide by 12.5 in. high at the feed end, and 43.5 in. long. The suction pipe is 31 in. long and 4 in. in diameter.

Across the opening of the box and parallel to the ground line are four vanes or sand deflectors, placed at such an angle from the vertical that any material fed from the roller when the air current is not on will be deflected to the outside of the box.

The principle of operation of the aspirator is as follows: The graphite, being lighter in weight and of a flat shape, will, of course, be deflected further from the vertical by a horizontal current of air than the heavier and more massive sand particles. For this reason, the graphite will be carried further into the box than the heavier and more massive sand material, which will fall on the vanes and be thrown to the outside of the box.

The results obtained indicate that although some of the impurities can be removed with the aspirator, thereby materially raising the grade of the original material, the application of this type of machine will never be general.

It has been known for a long period that the coarse sand particles cause the greatest destruction of the large flake in the buhr mill. When the concentrates carry a large proportion of sand particles of such nature that the type of treatment described will raise the grade of the crude product to 70 per cent or better, there can be no question that the aspirator can be used to great advantage before treating the concentrates in the buhr mill. It is to be understood, however, that unless there is a comparatively large proportion of such impurities in the crude concentrate, the aspirator cannot be used to best advantage. The apparatus should certainly not be incorporated in a finishing mill except after thorough and comprehensive tests to determine

*Abstracted from War-Minerals Investigation Series Bulletin 8, Bureau of Mines, Washington, D. C.

[1]Ferguson, H. G., "Mineral Resources U. S., 1917," U. S. Geological Survey, 1918, p. 97.

the results that can be obtained by its use, and then only on the advice of a competent engineer conversant with the conditions that must be met by the installation.

Tests With Pneumatic Jig

The pneumatic jig differs in construction from the aspirator, although the principles involved in the operation of each are similar. This equipment has been manufactured on a commercial scale for several years, and its use would be advantageous when feasible, as a more simple and standard layout could be arranged than where improvised equipment like that described was used. Both types would be simple to operate, the aspirator, however, being capable of more sensitive adjustment.

The jig used in the experimental graphite work was a small laboratory apparatus, built by the manufacturers of the standard machine, for laboratory experiments. It consists of a small metal box, the bottom of which is made of a screen 3.25 by 2.5 in. Air pressure of 2 to 4 oz., furnished by a pressure blower or compressor, is admitted to the bottom of the box under the screen through a small rapidly rotating valve. The rapid pulsation of the air, due to its passage through the valve, causes the material on the screen to remain in continuous agitation and suspension. Consequently, the coarse and heavy impurities collect at the bottom of the material on the screen, the lighter graphitic material being stratified above the sand. The jig is so arranged that the operation is continuous, the heavy sand impurities being constantly collected and discharged from one side, whereas the lighter graphite is separated above the sand and discharged from the top of the column and on the other side.

Air Jig Produces Clean Tailing

The field of application of the air jig is practically the same as that of the aspirator. The results indicate that the air jig can be made to produce a cleaner tailing than the aspirator, but that the aspirator will give a higher grade of finished product. This condition will not, however, interfere with the usefulness of the jig, provided the material removed from the crude concentrate by it is the coarse-sand particles that cause the high loss of coarse flake in the buhr mill. Inspection of the various products of the jig will indicate that it does remove the coarse-sand particles.

Many of the remarks regarding the use of the aspirator will apply also to the air jig. There is no question that under certain circumstances the jig can be made to do valuable work in the preparation of crude graphite for crucible making, but the character of the crude concentrates themselves, and the other factors that enter into the commercial finishing of concentrates, must be considered before the jig is recommended for use in preliminary treatment. If the jig is used, and used only to do that for which it is particularly adapted—the removal of coarse-sand impurities—its success can be assured.

Probably the most striking characteristics of graphite flakes are their toughness and the shape of the individual particles. In these two respects the flakes differ greatly from the impurities usually associated with the graphite in the crude concentrates. It was hoped, therefore, that these properties could, in some manner, be utilized in separating the graphite from the associated impurities. In considering the matter, it was decided that although the coarse-sand impurities were much harder than the graphite flakes, they were, at the same time, so much more brittle than the carbon that the concentrate could be ground in some manner so as to materially reduce the size of these hard, brittle particles without causing a material reduction in the size of the graphite particles themselves. A careful survey of the different classes of grinding machinery indicated that this operation could be carried out with the greatest chance of success in a mill of the ball or pebble type.

The difference in the specific gravity of the two classes of substance was also a reason for believing that this method of selective grinding could be done. It was thought that, under correct conditions of dilution, the heavier, sandy material would tend to classify in the bottom of the charge among the grinding balls, where it would be ground more than the graphite, which, because of its lighter weight, would tend to segregate higher in the charge and out of the grinding zone. Such a separation corresponds closely to that in a hydraulic classifier. The results obtained from experiments proved that in most particulars the assumptions were fundamentally correct.

Separation of Sand and Carbon

After a treatment such as suggested, which would produce a product with the sandy constituents ground to a finer size than the flake graphite present, two means of separating the sand and carbon would be available. One of the methods, as might be expected, would be a screening operation. In fact, it was found that after such grinding it was possible to raise the grade of the original material 25 per cent or more by simply passing the ground concentrate over a 100-mesh screen.

In summarizing the results obtained by the pebble-mill grinding, it may be said that the apparatus, when operated under the conditions that have been determined to be the most satisfactory, will raise the grade of the + 100-mesh material in a crude concentrate to such a degree that the following buhr-mill grinding can be carried on to give the maximum results possible with it. At the same time, the results indicate that the pebble mill cannot be used to produce a finished grade of product. In other words, the pebble-mill grinding should be used only as a step in the process, and that step only preparatory to treatment in the buhr mill.

The choice of method of removing the impurities that are ground in the pebble mill will depend on the character of the concentrates that are being treated and on other conditions that will be encountered in the commercial finishing plant. The results obtained in the experiments here described indicate clearly that the field of the pebble-mill grinding is wide and that the process can be made to produce favorable results even under the most adverse and difficult of operating conditions.

Tests With Electrostatic Separator

The great difference between the electroconductivity of graphite and that of the principal impurities associated with it in the crude concentrates early suggested that a method of separation based on electroconductivity might be developed. Such a method has already been tried to a certain extent in the Alabama field, but the results in general have been unsatisfactory. This failure has been due to two difficulties. The first of these was

that most of the concentrates produced in the district contained a large amount of iron oxide, which, obviously, could not be removed with an electrostatic machine. Of course, crucible stock containing a large quantity of iron oxide could not be sold. The other reason for the failure ot the process was principally that mechanical faults developed in the electrostatic separator when attempts were made to treat a product containing such large quantities of light, electroactive material.

However, in one section of the field producing concentrates high in mica but low in iron, the process worked well on a commercial scale, and is now being used. Such material is particularly adapted for electrostatic treatment; hence the process gives ssatisfactory results, although certain changes in the separator, as originally designed, were made to overcome inherent mechanical defects. This condition was only local, however, and electrostatic separation was never successfully used in the remainder of the district.

Improvements in the concentration mill made it possible to produce a concentrate carrying so much less iron that it was thought that the iron would no longer be a determinating factor, and that, consequently, the electrostatic process should offer much more chance for success than previously. Thus, in order to use this method of separation, it seemed necessary only to construct a machine that would eliminate the mechanical difficulties previously encountered in the operation of this type of apparatus.

Electrostatic Tests Often Unsatisfactory

With this end in view, a series of experiments was made with a large machine of the type at present on the market, to determine definitely the reason for its previous failure. However, with this machine the separation was not satisfactory. The poles of the machine are so arranged that the graphite particles receive a certain charge and are thrown into the field of the pole carrying the opposite charge. When the graphite particles come under the influence of the charge of the latter pole, the charge first obtained is neutralized and the particles are thrown in the direction of the first pole. In this manner the material progresses through the apparatus in a zigzag path, first in one direction and then in the opposite, with the result that no separation of the graphite from the non-electroactive particles is obtained. The sand and other impurities, being unaffected by the charges acting on the graphite, fall directly through the machine. It can be seen, therefore, that the graphite will be separated from the impurities while passing the first pole; but on passing the oppositely charged pole will be thrown in the opposite direction and into the sand from which it has just been separated. Eventually the mixture is discharged practically unchanged from its original state.

The experiments demonstrated that to overcome the faults mentioned it would be necessary so to design a machine that when a graphite particle had received a charge of a certain sign, it would carry this charge unneutralized, and not be forced in the opposite direction and lose its tendency to separate. Many experiments were made with this end in view, and two types of apparatus were constructed. It was found possible to build a machine of such a nature that only one set of poles would tend to give a charge to the graphite, which would be repelled directly into the concentrate hopper and given no chance to be neutralized and thrown back into the impurities from which it had been separated.

Fig. 1 shows the principal details of the separator as finally constructed, and indicates the manner of its operation. The material to be treated is placed in the hopper at the top of the apparatus and fed from it by a roller in the bottom. The graphite first strikes one of the inclined planes that carries a weak negative charge. While the graphite is on this plane it therefore receives also a weak negative charge. As the plane and the graphite both have the same charge, the graphite will be repelled and will jump from the negative vane into the field induced by the positive vanes. On coming into this opposite field, the graphite gives up its weak negative charge and receives, instead, a much stronger positive one, which, in turn, causes it to be repelled violently from the positive plate and through the openings shown between the electrodes. After having passed to the back of the plates, the graphite is free to fall directly into the concentrate hopper at the bottom of the separator.

The sand and mica, being much poorer conductors of electricity, receive such a weak charge from the negative plate on which they first fall that they are not repelled into the strong positive field, but simply slide from one negative plate to the next, and so on down through the machine, until finally discharged into the tailings hopper at the bottom of the apparatus and in front of the concentrates hopper.

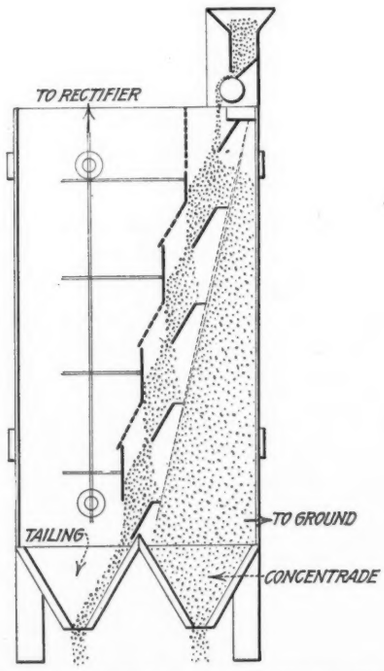


FIG. 1. ELECTROSTATIC GRAPHITE SEPARATOR

Summary of Results With Electrostatic Separator

The results obtained with the electrostatic separator prove conclusively that electrostatic separation can be successfully used in the finishing of graphite. They also indicate that the separators now on the market must be changed in certain respects to make it possible to obtain satisfactory results by their use. The results also seem to prove that the apparatus has a wider application than is possible with any of the other devices tested, with the possible exception of the buhr mill.

The electrostatic process seems also to be economical.

The cost of power is low and the loss of coarse and valuable flake is small. At the same time, it is to be expected that, although the device will invariably improve the grade of the concentrates treated, it will not yield a finished product containing 90 per cent carbon, which is considered necessary for crucible manufacture. However, the improvement in grade of the concentrates tested was so great as to indicate that electrostatic separation will, with few exceptions, produce a feed for the buhr mill that will be ideal for that apparatus to finish to the crucible requirements without a prohibitive loss of coarse flake. The removal of the coarse sand was almost complete.

The results already recorded show that, although the

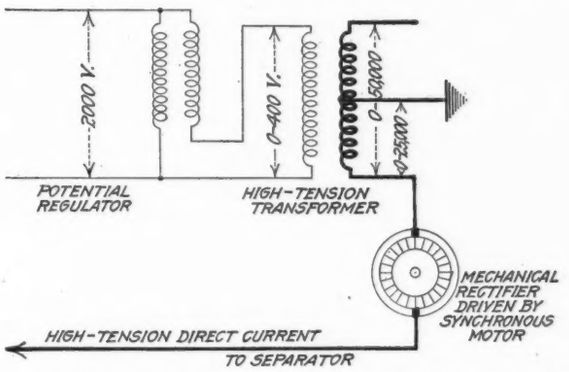


FIG. 2. WIRING DIAGRAM OF ELECTRICAL EQUIPMENT USED FOR ELECTROSTATIC GRAPHITE SEPARATOR

electrostatic separator will improve the grade of the concentrates, the degree of improvement will vary. Seemingly, the degree of variation depends on the physical condition of the concentrates themselves previous to treatment. In other words, the results to be obtained with this separator, as with those of any other type of equipment, will depend on the concentrates themselves, and consequently there can be no doubt that conditions will sometimes be met under which this type of treatment would not be as satisfactory as some other that might be developed for the removal of the coarse sand. However, the process has a more general application than is possessed by any of the other methods thus far described.

Flotation as a Finishing Process

Flotation as a process of concentrating the graphite content of ores has been used for some time and with a fair degree of success. For this reason, and because graphite has a much greater tendency to float than the impurities that are usually found associated with it, the idea of re-floating the concentrate to remove the impurities before buhr-mill treatment was suggested.

There are two primary reasons for thinking that flotation could be used in this connection. The first is the law of concentration that the grade of the concentrates produced by a concentration process will vary directly with the richness of the feed being treated. As it is possible to produce a 45 per cent graphite concentrate from ore carrying only 3 per cent graphite, it is reasonable to believe that, under the proper conditions, it should be feasible to make a concentrate carrying, say, 70 per cent or more graphite from a feed carrying 40 per cent or more of graphite.

The results obtained make it evident that simple re-flotation, without a preliminary treatment, will materially raise the grade of the product, and give a high recovery of the carbon content of the feed. However, as would be expected, the results do not indicate that simple re-flotation would be satisfactory in commercial practice.

As regards re-flotation following treatment in buhr or pebble mills, the results are such as to justify its adoption in a commercial installation. Both the mechanical and the pneumatic types of flotation machines were used in the tests, and, as far as could be noted, neither machine could claim an advantage. Several oil mixtures were used. A mixture of 2 lb. of No. 17 oil and 0.75 lb. of No. 5 oil, both made by the General Naval Stores Co., was found satisfactory in every case.

The Buhr Mill: Its Place in Graphite Finishing

During the comparatively long period that the buhr mill has been employed to finish graphite, methods of overcoming inherent difficulties in its use have become evident. One requirement is that the concentrate be of comparatively high grade before grinding in the buhr mill. With such material, no difficulty is encountered in consistently producing a crucible stock assaying 90 per cent graphite, provided the other conditions are correct. That the excessive destruction of coarse flake incident to buhr-mill grinding may be eliminated, it is necessary to remove only the coarse, gritty particles, or, at least, those coarse enough to require a large amount of grinding in the buhr mill. Stated simply, when the buhr mill is operated principally as a grinding machine on low-grade material, the grade of the product resulting cannot be depended upon, and an excessively large proportion of the flake will be ground to dust. When, on the other hand, the machine is operated only as a polishing or buffing machine, it will give satisfactory results.

The limitations of the mill were realized early in the progress of the work, and the experiments were conducted accordingly. Most of the products resulting from the various treatments contained less than the required 90 per cent of carbon, and, therefore, could be used by the crucible makers only after a treatment in the buhr mill, to bring them to the necessary grade.

General Summary and Discussion of Results

As a result of the investigations made to determine the most satisfactory methods of refining crude graphite concentrates, several important facts were developed. Probably the most important of these is that each concentrate to be treated is a problem in itself, and, therefore, no complete plan of treatment applicable to all kinds of concentrate can be prescribed. Such a limitation is due to the differences beteen the characteristics of the crude graphite flakes and of their associated impurities. The most important characteristics that will effect the type of treatment scheme to be applied are the hardness, toughness, diameter, and thickness of the flakes and their contents of interfoliated impurities. The different physical properties affect the amount and intensity of the grinding necessary to remove the impurities without the destruction of too large a proportional amount of the large and more valuable flakes.

Another important factor in determining a satisfactory finishing process is the kind of impurities that must be removed. When these impurities exist free from the flakes of carbon, they can be removed, to a great degree, with a small loss of coarse carbon. When these impurities are soft and of small size, they can

be removed after a slight and non-destructive grinding operation, which will, in all probability, cause a comparatively small loss of valuable flake.

On the other hand, coarse, hard impurities are much more difficult to handle in a satisfactory manner. This type of material offers the greatest problem to the operator of the finishing mill. The results obtained in the experiments indicate that the efficiency of the finishing process will depend on the success obtained in the removal of this type of impurities at the earlier stages of the finishing operations.

The investigations have also brought out the fact that the buhr mill is a necessary apparatus in all processes for graphite finishing. It separates the flakes into their constituent laminations, and prepares them for the removal of the interbedded or interfoliated impurities.

The aspirator and the pneumatic jig were found to have an application under certain circumstances. It was seen, however, that such apparatus can be considered only for preliminary treatment previous to the regular finishing process, and should be used only for the removal of coarse, hard, free impurities that are sometimes encountered.

The experiments proved fairly conclusively that the use of either the electrostatic separator or the pebble mill, followed by flotation, will be applicable to all types of concentrates produced in the Alabama fields. The material produced by either of these types of apparatus can be ground in the buhr mill with satisfactory results.

The different processes of finishing graphite may be classified under two general heads—wet and dry. The decision as to which of the two should be used is dependent on the characteristics of the concentrates themselves. It is important that neither be adopted except after the necessary experiments and on the advice of an engineer thoroughly conversant with the problems to be encountered in the treatment of the particular concentrate, and with the economic conditions that will exist in the operating plant.

It can be said that, with rare exceptions, a satisfactory crucible stock can be produced from all of the concentrates that are at present made from the Alabama ores, and that the recovery of +100-mesh flake at the majority of finishing plants now operating can probably be improved. It should be possible to keep the recovery of material coarser than 100 mesh at 70 per cent of the total carbon in the original concentrates, and in many cases this can be increased to 80 per cent or more. These figures are sufficiently high to make profitable many of the plants that are now being operated at a loss.

The results obtained in finishing the graphite concentrates are dependent largely on the character of the crude flake contained in the ores. Moreover, mills that are producing a potential crucible stock in their concentrating plants can also produce a satisfactory crucible stock at a profit from a finishing plant that is correctly designed and intelligently operated. The operator who is unfortunate in having to mine small, low-grade flake requiring a large amount of intensive grinding and associated with a large quantity of coarse siliceous or micaceous impurities will have difficulty in producing the required grade of crucible stock at a profit. In common with all mining ventures, successful operation depends more on the character of the raw material occurring in the ground than on the treatment given the ore after it has been mined.

Chemical Industries Exposition

Companies Which Will Exhibit—Meetings of the American Institute of Mining and Metallurgical Engineers, American Electrochemical Society and Other Organizations

AS PREVIOUSLY announced in the *Journal* the national exposition of the chemical industries will be held during the week of Sept. 22 in Chicago, during which time a number of societies will also hold meetings. The American Institute of Mining and Metallurgical Engineers will occupy the first part of the week. The American Electrochemical Society will hold its meeting on Sept. 25, 26, and 27. The following companies are among those which will have exhibits at the annual exposition:

Abbe, Paul O.
Ainsworth, Wm. & Sons
Allen Electrolytic Cell Corporation
American Chemical Society
American Chemical & Manufacturing Co.
American Cyanamid Co.
American Electrochemical Society
Anaconda Copper Mining Co.
Armstrong Cork Co.
Austin Co.
Bailey Meter Co.
Barrett Co., The
Bausch & Lomb Optical Co.
Brown Portable Conveying Machinery Co.
Canadian Electrode Co.
Carborundum Co., The
Celite Products Co.
Central Scientific Co.
Carnotite Reduction Co.
Chemical & Metallurgical Engineering
Chemical Catalogue Co. Inc.
Cleveland-Cliffs Iron Co.
Coors Chemical Porcelain Co.
Corning Glass Works
Crane Co.
De Laval Separator Co.
Denver Fire Clay Co.
Dings Magnetic Separator Co.
Dow Chemical Co.
Duriron Castings Co.
Eimer & Amend
Electric Furnace Co.
Electrolytic Engineering Corporation
Foote Mineral Co.
Fuller Lehigh Co.
General Chemical Co.
General Electric Co.
General Filtration Co. Inc.
Groch Centrifugal Flotation Co.
Goulds Manufacturing Co.
Hardinge Conical Mill Co.
Hercules Powder Co.
Harold China & Pottery Co.
Huff Electrostatic Separator Co.
Industrial Electric Furnace Co.
Journal of Industrial & Engineering Chemistry
Lead Lined Iron Pipe Co.
Little, Arthur D. Inc.
MacBeth Evans Glass Co.
Magnetic Manufacturing Co.
McGraw Hill Co. Inc.
Merck & Co.
Metals Disintegrating Co.
Mineral Point Zinc Co.
Nash Engineering Co.
New Jersey Zinc Co.
Norton Co.
Oliver Continuous Filter Co.
Ontario Bureau of Mines
Permutit Co.
Pennsylvania Salt Manufacturing Co.
Raymond Bros. Impact Pulv. Co.
Research Corporation
Roessler & Hasslacher Chem. Co.
Rossendale-Reddaway Belting & Hose Co.
Schutte & Koerting Co.
Sperry Co., D. R.
Sturtevant Mill Co.
Sullivan Machinery Co.
Taylor Instrument Companies
Texas Gulf Sulphur Co.
United Filters Corporation
United Lead Co.
United Lined Tube & Valve Co.
U. S. Cast Iron Pipe & Foundry Co.
U. S. Bureau of Mines
Union Sulphur Co.
Virginia Smelting Co.
Wedge Mechanical Furnace Co.
Westinghouse Elec. & Manufacturing Co.

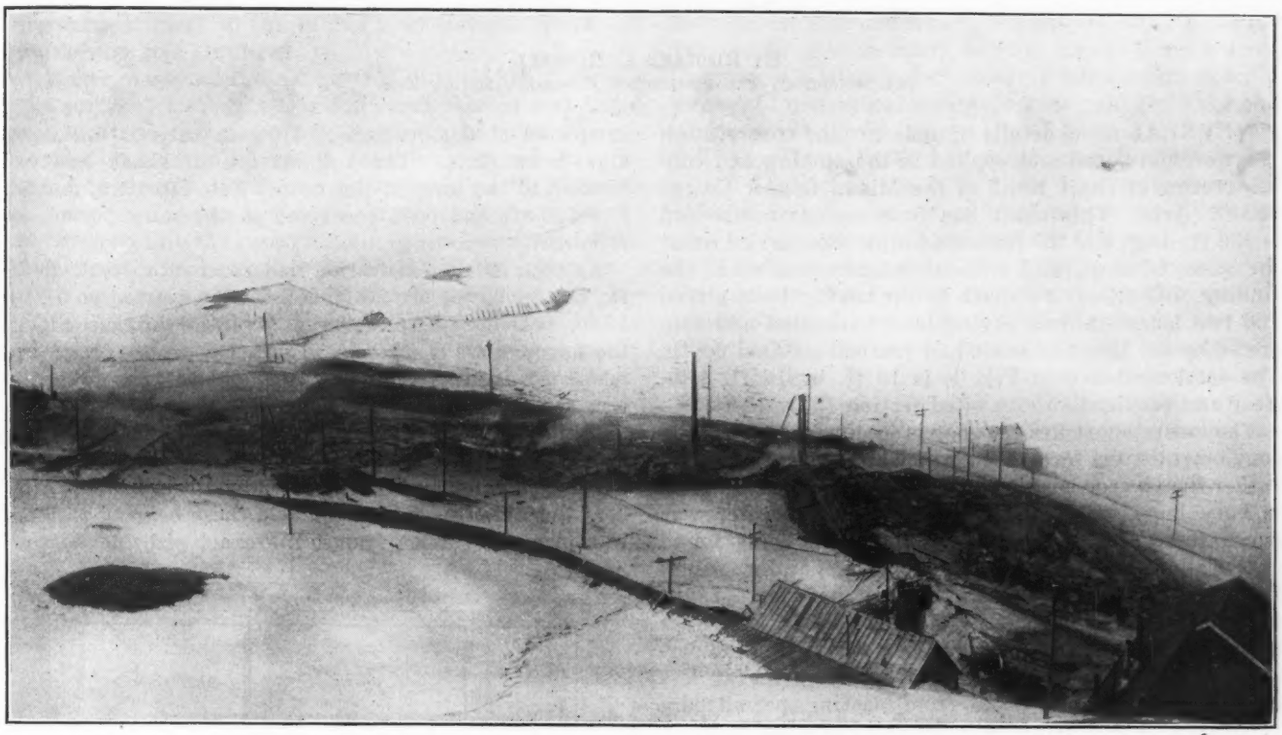
Prices of Milling Supplies in New York

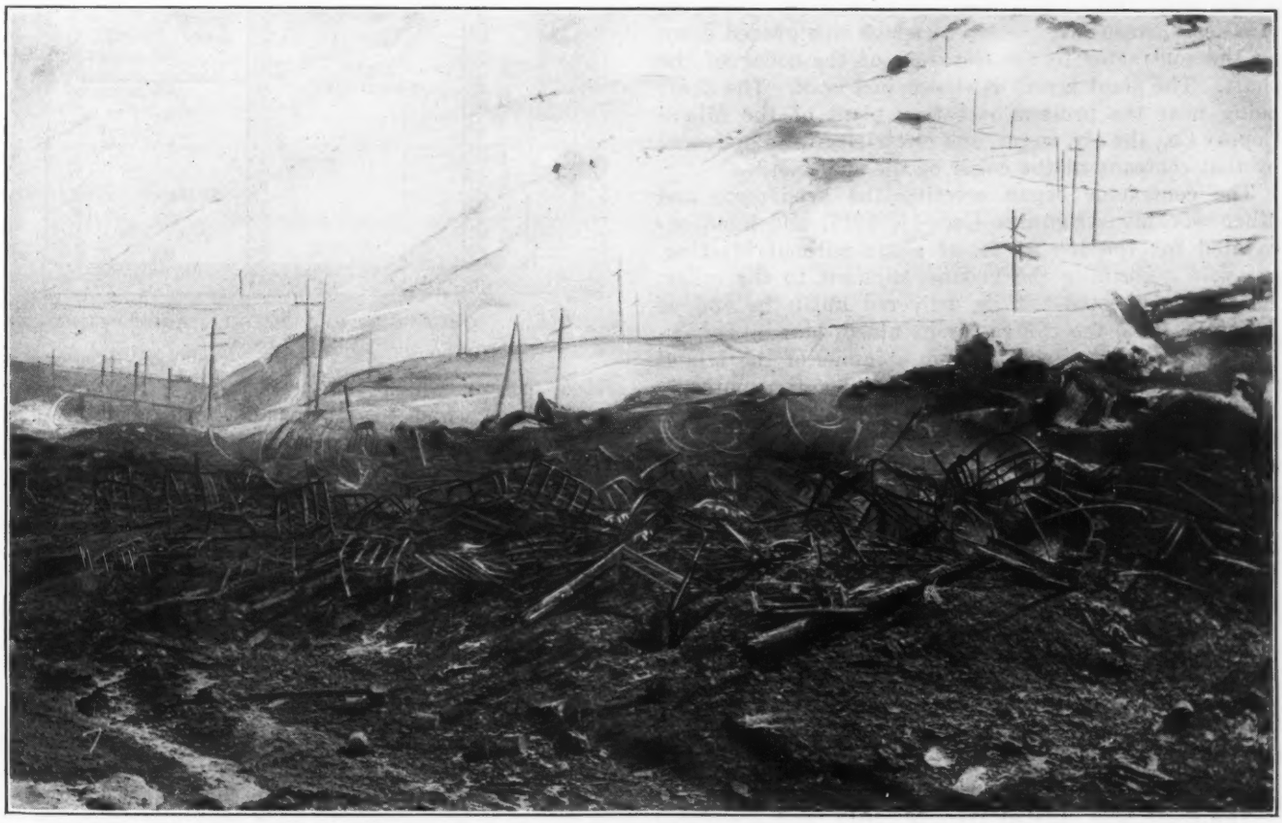
The following table shows the fluctuation in prices of milling supplies during the last two years from July, 1917, to June, 1919.

1917–1919 PRICES OF MILLING SUPPLIES IN NEW YORK

Supplies	July, 1917	Dec., 1917	July, 1918	Dec., 1918	June, 1919
Leather belting, heavy, discount, %	35	35	35	.....	25
Rubber air hose, ¾-in., first grade per ft.	$0.55	$0.60	$0.60	$0.60	$0.50
Cotton waste, white, per lb.	.13	.11	.11	.11	.11
	.15	.13	.13	.13	.13
Packing, rubber and duck for low-pressure steam, per lb.	.....	.77	.99	.99	.95
Packing, asbestos for high-pressure steam, per lb.	.....	1.54	1.76	1.76	1.60
Packing, rubber and duck for piston packing, per lb.	.....	.88	1.10	1.10	1.00
Pure steam-distilled pine oil, per gal., in bbl.	.50½	.50½	.56	.65	.70
Pure destructively distilled pine oil, per gal., in bbl.	.40	.40	.49	.65	.63
Pine tar oil, per gal., in bbl.	.26	.28½	.35	.38	.45
Crude turpentine, per gal., in bbl.	.37	.37	.40	.45	.61
Hardwood creosote, f.o.b. Cadillac, Mich., per gal., in bbl.	.19½	.19½	.23	.23	.23
Sodium cyanide, per lb.	.30	.37	.39	.30	.30
Zinc dust, 350 mesh, per lb.	.16	.18	.16	.16	.10

PHOTOGRAPHS FROM THE FIELD





DISASTROUS FIRE AT PROPERTY OF SUNNYSIDE MINING AND MILLING COMPANY, EUREKA, COLORADO

The fire, which occurred on Apr. 21, originated in the third story of one of the bunk houses. The following buildings were completely destroyed: Boarding house, two bunk houses, moving-picture hall, commissary, and compressor plant. The following buildings were saved: Tramway terminal, crushing plant, machine shop, blacksmith shop, and transformer plant. There was no damage to the tramway which connects with the 600-ton mill three and one-half miles distant.

Sinking and Concreting Mine Shaft 936 Feet Deep*

Lining and Walls of Four-Compartment Shaft No. 5 of Miami Copper Company Concreted Simultaneously With Excavation Operations—Blasting Impossible Below 200-Foot Depth

BY RICHARD L. RUSSELL
Superintendent, The Foundation Company, Miami, Ariz.

SEVERAL novel details in underground construction were developed and applied in the sinking and concreting of shaft No. 5 of the Miami Copper Co., at Miami, Ariz. This shaft has four compartments and is 936 ft. deep, and the concrete lining was carried on at the same time as, and without interference with, the sinking, 700 ft. of the shaft lining having been placed and two large stations having been excavated and concreted by the time the shaft had reached its final depth. The section, shown in Fig. 1, is 13 ft. by 16 ft. 4 in. clear and required an excavated section 15 by 19 ft.

The entire shaft lies in what is locally known as Gila conglomerate, a formation which is typical hardpan rather than a true conglomerate. Although the material is very hard, no blasting was done after water was encountered at a depth of about 200 ft., it being found practically impossible to remove the powder fumes from the fissures in the water-laden hardpan. Light jackhamers with "bull points" from 2 to 3 ft. long were used to break the ground. This method, besides permitting the walls to be trimmed neatly, with far less overbreak than would result from blasting, permitted a progress of 100 ft. per month.

The shaft was sunk on the side and near the top of a small, steep hill, the top of which was graded down by the contractor to the elevation of the collar of the shaft. The plant layout is shown in Fig. 2. The shaft being near the present operating plant of the Miami Copper Co., the air, water, and electricity were delivered by that company at the collar of the shaft.

The contractor began erecting the headframe and other working structures Dec. 11, 1917, and hand excavated for the top 25 ft. of shaft without blasting, to avoid disturbing the ground adjacent to the collar. As the hoist could not be delivered until the end of January, 1918, the contractor obtained, late in December, permission to drift in from a tunnel of the Miami Copper Co. which passed within 20 ft. of the southerly corner of the shaft at a depth of 118 ft. This permitted the tramming of muck by hand a distance of about 300 ft. through the tunnel to a dump in the gulch at the tunnel entrance.

After the line of the shaft was reached, a raise was driven for the purpose of meeting the excavation from the surface. This raise was 2½ by 6 ft., of which 2½ by 2 ft. was a manway with ladders and the remaining space was occupied by a cribbed chute. At the tunnel level the drift was widened and the full shaft section excavated to make a working chamber large enough to accommodate a switch, which permitted the sidetracking of an empty car while another car was being loaded. The full section of the shaft was then broken down through this chute by the use of 40 per cent dynamite.

The drift was started Dec. 26, 1917, and completed Jan. 1, 1918; the raise was started Jan. 2, 1918, and completed at 6 a.m. Jan. 8, 1919—a rate of 5 ft. per eight-hour shift. The full section of shaft was excavated to the level of the tunnel Feb. 20, 1919, and 60 ft. of shaft had been concreted in the same period, as follows:

As soon as the excavation had reached a depth of 35 ft., the forms for the 25-ft. collar were started on 12 by 12-in. bearing timbers placed in 18-in. hitches cut in the hardpan walls. No back forms were used, and the whole 25 ft. was poured continuously. As no water was encountered, no timbering was necessary.

While the collar was being concreted, the excavation had progressed to a depth of 55 ft. Hitches were again cut in the walls, and the three 12 by 12-in. bearing timbers were lowered into them. On these bearing timbers was placed a timber frame, the exact size of the concreted section, which served both as a bottom form and a sill on which the form panels could be set. The vertical reinforcing rods were then hooked to the verticals which had been left projecting from the bottom of the previous concrete, and the horizontal reinforcing was wired to the verticals. A 5-ft. section of forms was then placed, and concrete was poured, this process continuing until the concrete was carried up to the bottom of the collar section. It was found that the ground would safely permit the opening up of a depth of fully 25 ft. of shaft without lateral support, and the concrete was carried down in 20-ft. sections by the above process for the first 200 ft. of the shaft.

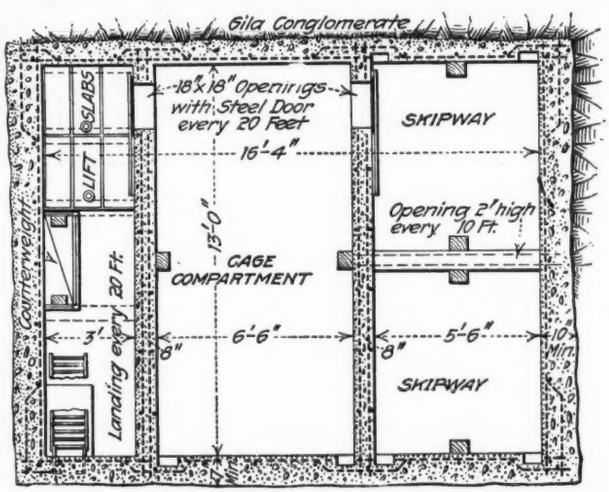


FIG. 1. CROSS-SECTION OF SHAFT, SHOWING CONCRETE LINING

As soon as the raise from the tunnel level was finished and the breaking-down process was well under way, a small air hoist was installed at the tunnel level, and the two skip compartments were sunk and timbered as a pilot shaft, the muck being hoisted to the tunnel level and also trammed through the tunnel. Thus excavation was being carried on simultaneously at two levels

*From *Engineering News-Record*, June 26, 1919.

without interference, while waiting for the double hoist to be delivered.

By the time the whole shaft had been excavated down to the tunnel level a two-compartment pilot shaft 100 ft. deep was ready, one compartment serving as a chute through which to draw off the muck from breaking down the full section of the shaft and the other a hoisting compartment to the tunnel level through which the muck was still trammed.

Water was encountered at this depth (218 ft. below the surface) and while the full shaft section was being excavated to this depth the double-drum hoist was delivered and installed and a special crosshead was devised to comply with the requirements of the Arizona mining laws and at the same time permit the bucket to be dumped into the receiving bin in the headframe without excessively increasing the height of the latter.

As it was neither possible nor desirable to keep the bucket guides extended nearer the bottom than 15 to 30 ft. while sinking was in progress, this crosshead had to be such that it could be stopped at any desired point in the shaft as well as at the headframe and allow the bucket or skip to continue on, for filling or changing at the bottom or dumping when reaching the headframe.

It was found that the water caused the hardpan to slough very treacherously soon after a wall was exposed. Full timbering was therefore carried on with the excavation from the 250-ft. depth; 8 by 8-in. plates, posts and dividers and 2-in. lagging were used. Corner joints were framed as shown in Fig. 4 to secure an increased bearing surface. As the shaft was concreted, all timber and lagging were removed and re-used, some timbers being used as many as four times. This not only resulted in a large material saving but also saved a high framing expense, as carpenters were paid $7.25 per shift at that time.

The section concreted in one operation was increased to 100 ft.; that is, the 12 by 12-in. bearing timbers were lowered 100 ft. and set in hitches and the 100-ft. section was concreted upward in 5-ft. courses.

The water was bailed into buckets and hoisted, five buckets per hour, or 600 gal., which, together with the water shoveled and hoisted with the muck, was sufficient to keep the bottom free. A timber bulkhead 6 in. thick was kept not over 50 ft. above the men working in the bottom over all of the shaft except the two skip compartments. While the reinforcing and forms were being set in one of the skip compartments all the

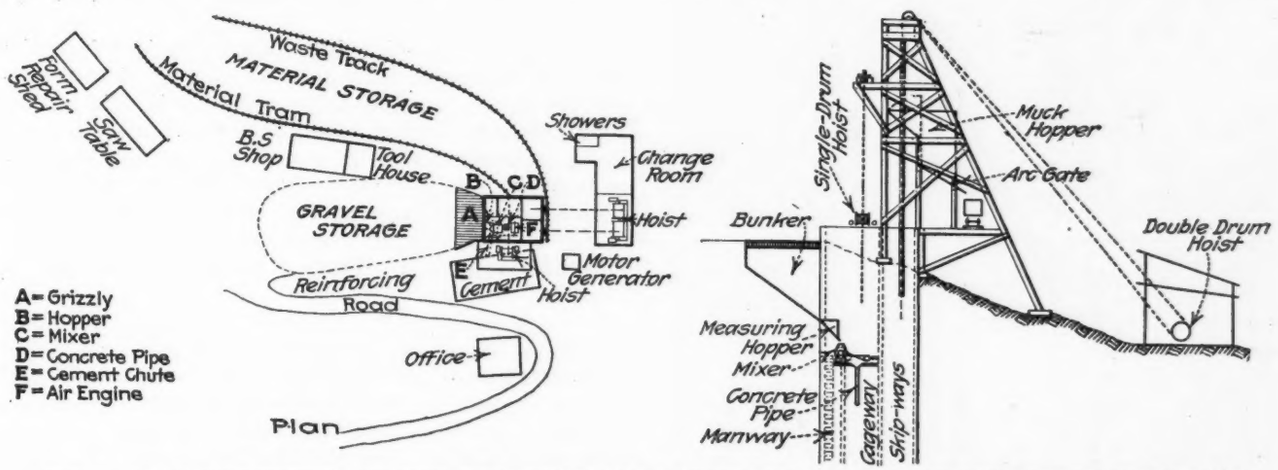


FIG. 2. PLAN AND SECTION OF CONSTRUCTION-PLANT LAYOUT FOR SINKING AND CONCRETING MINE SHAFT

This was accomplished by the arrangement shown in Fig. 3.

A lug D was securely clamped to the cable about 6 ft. above the shackle loop. This lug engaged the dogs B and thus attached the crosshead securely to the cable. When the crosshead reached the top of the headframe, the top lander pulled the lever E and slid the frame A over against the guides and gave the lowering signal. The bumper C then hit the frame A, the dogs B released the lug D, and the crosshead was left resting on the frame A while the bucket was dumped, after which the latter was raised high enough to take the crosshead off the frame A. The frame was then slid back and the bucket with the crosshead attached was ready for lowering. At the bottom of the shaft, or at any other point where free use of the bucket was desired, stop blocks E were bolted to the guides and performed the same function as the frame A at the headframe. This crosshead gave perfect satisfaction.

From the 218-ft. depth to the bottom the full section of shaft was excavated by the use of bull points; three men using jackhamers, working them into the material, loosened all that four muckers could load into the buckets.

hoisting from the bottom was done in the other compartments, and after the forms were set one of the skip compartments was bulkheaded at the level of the top of the forms, as were the cage and manway compartments, one skipway only being left open for hoisting.

Upon the completion by the contractor of the contract for lining with concrete the old shaft No. 3 of the Miami Copper Co., a mile distant from the new shaft No. 5, about Apr. 1, 1918, the single-drum hoist from shaft No. 3 was installed at shaft No. 5, as shown in Fig. 2, working from extension timbers from the same headframe and operating in the cage compartment.

This hoist handled all reinforcing, forms, concrete pipes, and timbers to the form and concrete gangs, and as there was always a bulkhead in this compartment over the men in the bottom, the danger of working at two different levels was greatly lessened. This hoist was also used in pulling and resetting the rather heavy wooden forms in all compartments. It proved nearly as fast as a derrick and obviated the use of the slow and expensive block-and-tackle method.

Separate bunkers for sand and gravel were excavated immediately adjacent to the collar of the shaft at the

manway end, and the sand and rock from the crushing plant, which was installed in the creek bed, were dumped through grizzlies into these hoppers. Through openings left in the shaft collar, with arc gates, the sand and stone passed into measuring hoppers inside the manway and cage compartments. These hoppers were of the proper dimension for a one-bag batch, and from them the material was chuted to a batch mixer in the shaft

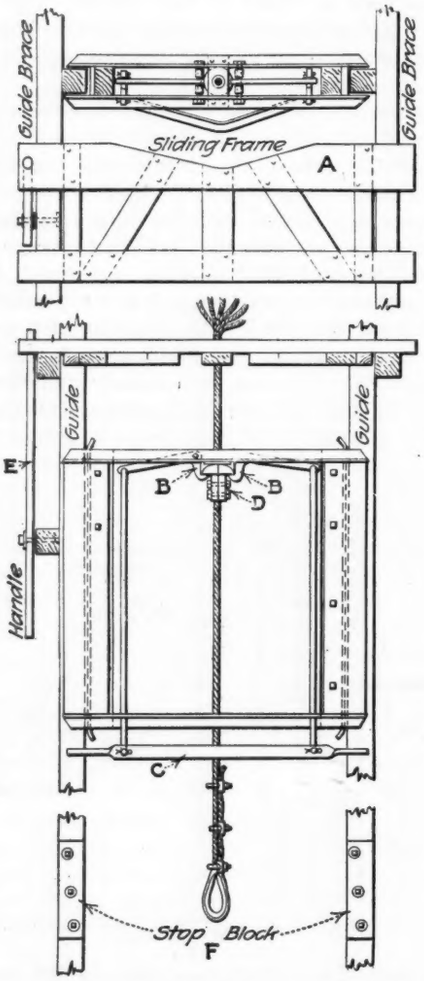


FIG. 3. CROSSHEAD AND SAFETY DEVICES

cageway compartment 20 ft. below the surface. The cement was slid in bags down a chute from the door of the cement shed through an opening in the south side of the cageway compartment directly to the mixing plant.

The mixer, of 8-cu.ft. capacity, was belt-driven from a small air hoist set at the same level. This plant occupied the southerly half of the cage compartment and manway compartment, the wall between the two being omitted temporarily for its accommodation, the whole plant occupying an area only 7 ft. by 9½ ft., as clearance for buckets, and material handled by the small hoist in the cage compartment had to be maintained at all times.

The 1 : 2 : 4 mixture of concrete was dumped from the mixer through a 6-in. iron pipe with screwed couplings and with the fall broken at junction boxes every 300 ft. and at the swiveled chute which carried the concrete to the forms around the shaft. This pipe was supported by timber clamps resting on 6 by 8-in. timbers carried in recesses left in the concrete when poured, and on the shaft timbers where the concrete had not yet been placed.

In the manway compartment the permanent iron ladders were put in position as the concrete lining was placed. In advance of that, the permanent ladders were placed on temporary wooden landings. Concrete-lined stations were constructed at 235, 490, 576, 643, 729, 770, 835, and 920 ft. below the surface. The 490- and 576-, also the 770- and 835-ft. stations were the top and bottom of future ore pockets. The ore pocket between the 643- and 729-ft. stations is now being constructed.

To facilitate the construction of these pockets, 4 by 4-ft. cribbed chutes were excavated before the shaft was concreted just outside of the concrete walls of the northwestern skipway, with a gate and a chute leading into the skipway at the bottom of each pocketway. When the ore pockets are constructed the muck will be shoveled into these chutes and drawn off at the bottom, and the cribbing removed as the excavation proceeds, thus effecting a considerable economy in the cost of excavation.

For the hoisting in the cageway compartment, cable guides were installed, carried on reels on the headframe and unreeled as the shaft was deepened, and even at the full depth of 936 ft. these did not oscillate enough to cause difficulty.

To avoid trouble with the permanent guides from the use of expansion bolt fastenings, and to obviate the irregular spacing of bolt holes in the guides if anchor bolts were set in the concrete as it was poured, a novel guide fastener was designed. It was built in the concrete as poured, but still allowed drilling of the bolt holes by templet after the shaft was completed and permitted a leeway for any reasonable irregularity in location while pouring. These fasteners are shown in Fig. 5.

A chart was kept showing the progress made each day by each shift on each part of the work. A large-scale elevation of the whole shaft, stations, tunnels and ore pockets was made, and a certain portion was allotted to excavation, timbering, form work, reinforcing, concreting, and other construction processes. To each shift boss was assigned a certain color, and the portion of the chart representing the position and the amount

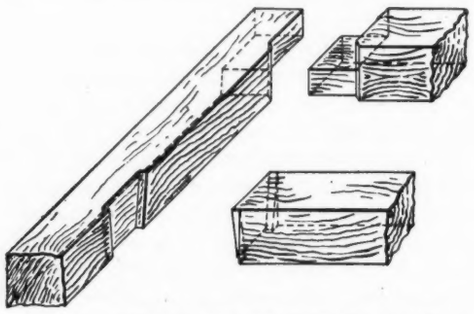


FIG. 4. DETAIL OF TIMBER FRAMING

of work done was colored for the shift doing the work. The date was then written through the color. Quantities for this purpose were determined both by actual measurement and by the foreman's reports. For instance, the number of buckets of muck hoisted was a close check on the advance in sinking for that shift. The foremen were never formally notified that this chart was being kept, but within two days from the time it was instituted they all seemed familiar with it and watched it closely.

The chart not only furnished information as to progress at all times and gave a comparison of the work accomplished by each shift, but it also served as a record which showed at a glance which shift boss had excavated any part of the work. If faulty workmanship had been discovered it would have been simple to trace it.

Probably the greatest value of the chart, however, lay in the competition it aroused among the shift bosses, who realized that their work was being closely followed and that they were getting due credit.

In spite of the fact that the hardpan through which the shaft was driven is so firm that all former shaft

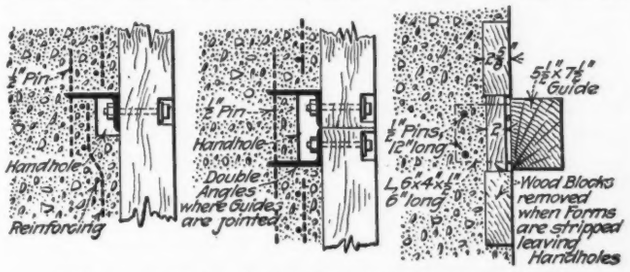


FIG. 5. DETAIL OF NOVEL GUIDE FASTENING

sinking in the district had been done by blasting, it sloughed badly upon exposure to the air, and this without warning. Ground which had been sounded and found solid but a few minutes before would suddenly fall, with no warning, so that the sinking combined the difficulties of both hard-rock work and soft, treacherous ground. In spite of this fact, there have been no serious accidents to either construction or the employees during the entire work, which means that though every precaution has been taken to safeguard the men and the work, good luck has also favored the job.

The Foundation Co., of New York City, did this work by contract, under the supervision of its Pacific Coast department, with Bayly Hipkins, vice-president and Pacific Coast manager, and A. S. Lilley, assistant manager; and under the direct charge of the writer as superintendent, James H. LeFeaver as assistant superintendent and John Sheehy as night superintendent.

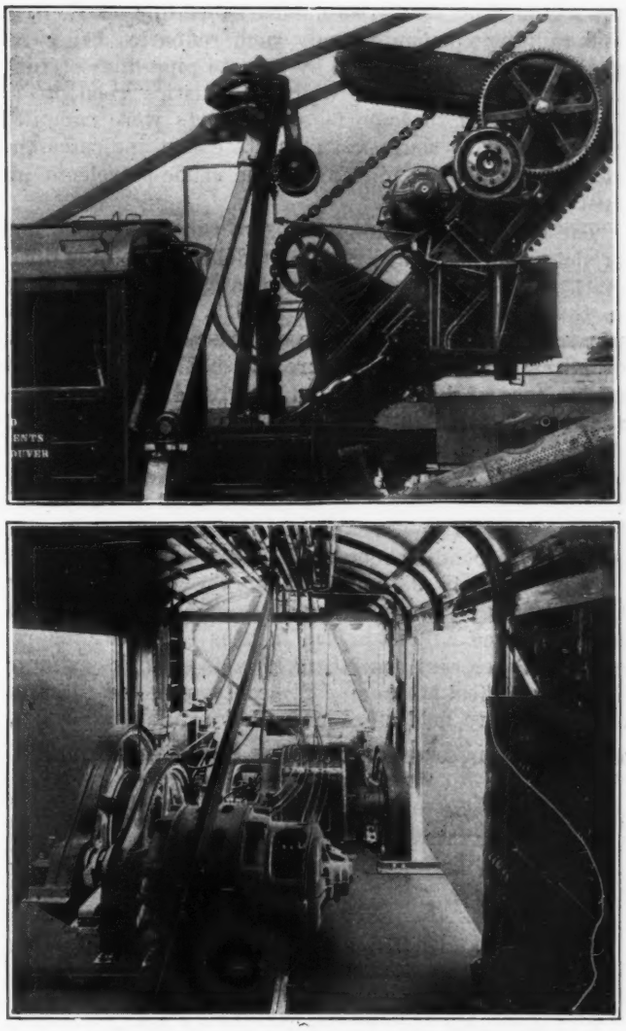
Copper Range Co.

The Copper Range Co., reporting operations during 1918 at the Baltic, Trimountain, and Champion mines, states that 792,151 tons of rock was stamped and 26,623,940 lb. of refined copper produced, and that these figures represent 33.61 lb. of copper per ton of ore stamped. The total cost per lb. of copper produced was 14.46c., and the average price received was 24.76c. Total expenses amounted to $3,849,216.38. Net earnings were $2,895,615.28 and dividends $2,336,394. It should be noted that the above figures include only one-half of the Champion's operations, the property being owned jointly with the St. Mary's Mineral Land Co.

At the Baltic mine, No. 3 shaft was sunk 178 ft., and 11,901 ft. of drifting was done, together with 164 ft. of sub-drifting, 965 ft. of crosscutting and 663 ft. of raising. At the Champion mine, No. 2 shaft was sunk 95 ft. and 3146 ft. of drifting was done, together with 35 ft. of crosscutting, 202 ft. of sub-drifting and 1022 of raising. At the Trimountain mine, No. 2 shaft was sunk 159 ft. and No. 4 shaft, 154 ft. Drifting at the mine totaled 4913 ft.; sub-drifting, 1362 ft.; crosscutting, 289 ft. and raising, 841 feet.

Motor-Driven Shovels and Draglines

In stripping overburden or performing work of a similar nature where the use of steam shovels or draglines is desirable, it will often be found that the utilization of electrically driven equipment is an economy, especially where the electric power is available and can be secured at reasonable rates. Some of the advantages obtained by the use of the electrically driven shovel and dragline are that fewer operators are required; fuel is not an essential; no water supply or boiler is needed, and no smoke, no sparks and no objectionable



MECHANISM ON ELECTRICALLY DRIVEN SHOVEL
Top—Motor installation on shovel boom. Bottom—Driving mechanism in interior of shovel.

noises are present, and more material can be handled if the proper arrangements are made for car supply.

A complete line of electrically operated shovel and dragline equipment which meets the severe service encountered in such work, and embraces simplicity in design, has been placed on the market by the Westinghouse company. In general, the situation of the shovels makes alternating-current equipment preferable, although both alternating and direct-current equipment can be furnished. The accompanying cuts show motor installations on a shovel boom and the driving mechanism in the interior of a shovel, where motors are used to operate the hoisting drum and to swing the boom.

Petroleum in April and March

Production and Consumption of Domestic Crude Petroleum—Stocks on Hand—Imports and Exports—Total Consumption of Domestic and Imported

A COMPARATIVE summary of the quantity of crude petroleum produced and marketed, imported, consumed and exported in April and March, 1919, and in April, 1918, prepared by C. C. Osbon, under the supervision of E. Russell Lloyd, of the U. S. Geological Survey, is given herewith. The statements with regard to fields east of the Rocky Mountains are based upon reports filed by about two hundred pipe-line, marketing, and refining companies, only such refineries being included as receive crude oil by private pipe lines or tank cars directly from the wells. Statistics relating to California and to imports and exports were compiled from secondary sources. This statement indicates the general trend of conditions in the crude-petroleum industry of this country.

The quantity of crude petroleum run from wells and producers' field storage tanks and delivered to pipe lines, marketing companies, refineries, and other consumers in the United States in April, 1919, amounted to approximately 29,310,000 bbl., a decrease of 1,102,000 bbl., or nearly 4 per cent, compared with March, 1919, but an increase of 461,000 bbl., or nearly 1½ per cent, compared with April, 1918. The average daily rate in April, 1919, was 977,000 bbl., a quantity less by 4,032 bbl. (a little over 0.4 per cent) than the average daily rate in the preceding month, but greater by 15,367 bbl., or about 1½ per cent, than the average daily rate in the corresponding month of 1918.

Approximately 98 per cent of the oil included in the following table was actually brought to the surface in the United States in the months specified, the remaining 2 per cent consisting of runs or tank-car shipments from field storage. Data concerning the quantity of oil run into field storage are not available.

TABLE I. PRODUCTION OF DOMESTIC CRUDE PETROLEUM
(Barrels of 42 Gal. Each)

Field	April, 1919	March, 1919	April, 1918
Appalachian	2,542,000	2,453,000	2,178,000
Lima-Indiana	293,000	282,000	294,000
Illinois	1,008,000	1,166,000	1,145,000
Mid-Continent	14,048,000	14,629,000	14,182,000
Gulf Coast	1,843,000	1,890,000	1,745,000
Rocky Mountain	1,259,000	1,168,000	955,000
California	8,317,000	8,824,000	8,350,000
Totals	29,310,000	30,412,000	28,849,000

Petroleum Consumption

It is estimated that 27,726,000 bbl. of domestic crude petroleum was delivered in April, 1919, to refineries and other consumers of crude oil and used for the manufacture of petroleum products and for fuel, or exported. This quantity is less by 486,000 bbl., or nearly 2 per cent, than the quantity so delivered or consumed in March, 1919, and by 2,441,000 bbl., or about 8 per cent, than the consumption in April, 1918. However, the average daily rate of consumption was 924,200 bbl., an increase of 14,135 bbl., or about 1½ per cent, compared with the daily rate in March, 1919, but a decrease of 81,367 bbl., or about 8 per cent, compared with the rate in April, 1918.

The following table, computed from marketed production and stocks, includes approximately 99 per cent of the total quantity of domestic crude oil consumed or exported in the months referred to, the remainder representing oil used by producers in drilling and pumping.

TABLE II. CONSUMPTION OF DOMESTIC CRUDE PETROLEUM
(Barrels of 42 Gal. Each)

Field	April, 1919	March, 1919	April, 1918
Appalachian	2,359,000	2,359,000	2,204,000
Lima-Indiana	124,000	251,000	289,000
Illinois	797,000	580,000	1,368,000
Mid-Continent	13,664,000	13,553,000	14,352,000
Gulf Coast	1,272,000	1,251,000	2,215,000
Rocky Mountain	1,305,000	1,209,000	842,000
California	8,260,000	9,009,000	8,897,000
Totals	27,726,000	28,212,000	30,167,000

Stocks of Petroleum

The surface reserve of domestic crude petroleum held on April 30, 1919, by pipe lines and marketing companies and by refineries that receive it directly from the wells, was approximately 132,694,000 bbl., a gratifying increase of 1,584,000 bbl., or a little more than 1 per cent, compared with the quantity on hand March 31, 1919, but a decrease of 12,104,000 bbl, or about 8 per cent, compared with the quantity in storage on April 30, 1918.

From about 95 to 98 per cent of the domestic crude oil above ground in the United States in the months specified is included in the following table, the remainder representing unmarketed oil run by producers to private tanks and held as field storage.

TABLE III. STOCKS OF DOMESTIC CRUDE PETROLEUM AT END OF MONTH
(Barrels of 42 Gal. Each)

Field	April, 1919	March, 1919	Increase or Decrease April-March, 1919	April, 1918	Increase or Decrease April, 1919 Apr., 1918
Appalachian	4,246,000	4,063,000	+ 183,000	3,966,000	+ 280,000
Lima-Indiana	1,429,000	1,260,000	+ 169,000	1,594,000	— 165,000
Illinois (a)	3,823,000	3,612,000	+ 211,000	3,066,000	+ 757,000
Mid-Continent	79,567,000	79,183,000	+ 384,000	96,334,000	—16,767,000
Gulf Coast	10,131,000	9,505,000	+ 626,000	8,689,000	+ 1,442,000
Rocky Mountain	955,000	1,001,000	— 46,000	754,000	+ 201,000
California (b)	32,543,000	32,486,000	+ 57,000	30,395,000	+ 2,148,000
Totals	132,694,000	131,110,000	+1,584,000	144,798,000	—12,104,000

(a) Includes some Lima-Indiana oil stored in Illinois. (b) Includes stocks of residuum and unfinished refinery products.

Statistics for the California field in 1918 were compiled from figures published by the Standard Oil Co. (California), the Independent Oil Producers' Agency, and the Pacific Coast Petroleum War Service Committee, but for 1919 the figures are those of the Standard Oil Company only.

Petroleum Imports and Exports

The United States leads the other countries of the world in the production of crude petroleum, but the quantity obtained from domestic sources is inadequate to meet the demand, and a large volume is imported, chiefly from Mexico. Although the export trade of the petroleum industry in the United States consists chiefly of refined products, a substantial volume of crude oil is being exported for the manufacture of petroleum products in Canada, Cuba, and other foreign countries.

The following table was compiled from the records of the Bureau of Foreign and Domestic Commerce:

TABLE IV. IMPORTS AND EXPORTS OF CRUDE PETROLEUM
(Barrels of 42 Gal. Each)

Imports	April, 1919	March, 1919	April, 1918
Mexico	3,970,195	3,492,800	2,846,037
Other countries	14,000	981	205
Totals	3,984,195	3,493,781	2,846,242
Exports			
Canada	275,009	178,228	377,233
Cuba	1,429	39,384	5,912
Mexico	241	628	681
Other countries	1,240	144	875
Totals	277,919	218,394	384,701
Excess of imports over exports	3,706,276	3,275,387	2,461,541

Data are not available to show the quantity of Mexican crude oil held in storage in the United States. If, however, the consumption of Mexican oil keeps pace with importation, the following table indicates the total quantity of petroleum exported and delivered to refineries and other consumers in this country:

TABLE V. TOTAL CONSUMPTION OF DOMESTIC AND IMPORTED CRUDE PETROLEUM
(Barrels of 42 Gal. Each)

	April, 1919		March, 1919		April, 1918	
Kind	Total	Daily Average	Total	Daily Average	Total	Daily Average
Domestic	27,726,000	924,200	28,212,000	910,065	30,167,000	1,005,567
Imported.	3,984,195	132,807	3,493,781	112,702	2,846,242	94,875
Totals.	31,710,195	1,057,007	31,705,781	1,022,767	33,013,242	1,100,441

The foregoing data are subject to revision in subsequent statistical reports of the U. S. Geological Survey relating to crude petroleum.

North Star Mines Co.

The 1918 Report Shows Diminishing Operating Profits Due to Increased Costs — Champion Mine Produces Small Profit

THE North Star Mines Co. has had a long and successful record, but, like most gold-mining companies, it experienced marked operating disadvantages during the period of the war, on account of conditions beyond its control. The following information is taken from the company's last annual report and is presented in more detail than is customary, to illustrate the difficult conditions under which the company operated:

During 1918 the gross production of the North Star mine was $775,688.18; the expenses for current operation amounted to $716,778.14, and for development to $9225.70, or a total outlay for operation and development of $726,003.84, leaving an operating profit of $49,684.34. The gross production of the Champion mines was $271,108.40, and the expenses for current operation amounted to $235,363.18 and for development to $27,759.64, or a total outlay for operation and development of $263,124.82, leaving an operating profit of $7983.58. The total production of the company's mines was therefore $1,046,796.58, with total operating and development expenses of $989,128.66, leaving an operating profit of $57,667.92. Interest and dividends on invested funds amounted to $36,331.43, increasing the total net earnings of the year, before deduction of allowance for depletion and depreciation, to the sum of $93,999.35. The amount allowed for depletion and depreciation, on the same basis as in previous years, was $315,734.83, resulting in a deficit on the year's operations of $221,735.48. Of the dividends declared during the year, amounting to $100,000, the sum of $50,000 was derived from undistributed earnings of the year 1913, and, the surplus of previous years being exhausted, $50,000 was paid as a distribution of capital assets.

The conditions under which the business of gold mining was conducted during 1918 were so unfavorable and abnormal that the outcome affords no criterion of the results obtainable with ordinary factors of operation. The scarcity and inefficiency of labor and the high cost of materials used, combined with a lower yield per ton crushed, resulted in a situation at the North Star mines during the latter part of the year under which the cost of producing an ounce of gold exceeded the standard price at which it could be sold. Since the beginning of 1919 conditions have improved. The supply of labor is now fairly adequate; there is a declining tendency in the cost of certain supplies; and, although the process toward lower prices generally is likely to be a slow one, a gradual return to more normal conditions may be looked for.

The year's output from the North Star mine came chiefly from stopes on the 3400, 4000, 4400, 4700 and 5000 levels. A total of 130,445 tons of rock was delivered to the sorting plant, of which 30,895 tons was discarded as waste, leaving 99,550 tons of ore crushed, with an average yield of $7.79 per ton crushed, at an average cost of $7.20 per ton for operating and $0.09 per ton for development expenses, making an aggregate cost of $7.29 per ton crushed ($5.59 per ton mined), and leaving a realized profit of 50c. per ton crushed.

The yield per ton crushed in 1918 was $3.64 less than in 1917. This decrease was partly due to unfavorable operating conditions, the scarcity of labor making it necessary to mine the ore most readily available, without proper sorting, in order to keep the mill supplied, and partly to the fact that the North Star vein, so far as developed below the 4000 level, seems to be of poorer and less uniform quality than in the upper levels. The total cost per ton of operation and development in 1918 was $7.29, as compared with $7.19 in 1917. The average outlay per ton for development during the five preceding years was 65c. If an equivalent amount had been spent for development in 1918, the total cost per ton of operation and development would have been $7.85, as compared with $7.19 in 1917, $5.43 in 1914, and $5.20 in 1913.

Major Proportion of Yield Won by Amalgamation

Of the total production of the year, 82.03% was obtained in the mill by amalgamation; and 17.97% was recovered by cyanidation. It is estimated that the valuable material lost in the tailings amounted to about 33c. per ton crushed.

The development work done in 1918, restricted as above stated, amounted to 701 ft. of drifts, with results of no particular significance as to the opening of additional resources.

During the year, $27,681.21 was expended on improvement account, almost entirely in the erection of a plant for disposal of the tailings from the cyanide treatment, as required by the United States Debris Commission.

A reëstimate has been made of the ore reserves, with a reduction of about 100,000 in the number of tons counted as positively developed. The ore supply now available is estimated as sufficient to keep the mill supplied for two or three years. The prospects for developing additional resources, both on and above the 4000 level, and at the bottom of the mine, on the 6300 level, are favorable.

The Champion mines were operated throughout the year, with a production, as above stated, of $271,108.40, the yield of 41,300 tons crushed, or $6.56 per ton, resulting in a small profit over all expenses of operation and development. Nearly all of the ore came from 2400 to 2700 levels of the Providence mine.

Development work at the Champion mines amounted to 2109 ft. (drifts 1579 ft., raises 43 ft., and winzes 487 ft.). With the exception of the Providence 2700 orebody, the development work revealed practically nothing of value, and the outlook for the future is not encouraging. As long, however, as the production is sufficient to cover expenses, some further prospecting is justified.

The result of the Champion venture has been extremely disappointing. From 1911 to the end of 1918 a total of 228,810 tons has been milled, with an average yield per ton of $5.44, and the cost of operation and development per ton has been $8.04. The production obtained has been only about six tons of ore per foot of development; an exceedingly low ratio when compared with 20 to 25 tons per foot at the North Star.

Flotation Agents at Anaconda are delivered to flotation sections of the copper concentrator by means of a constant-speed disk-type feeder, with detachable cups, operating in a feeder tank or rectangular cross section. The amount of agent used is determined by measuring the volume removed from the feeder tank over a period of from one to four hours, depending upon the rapidity of flow from the tank. The specific gravity of the agent being known, the number of pounds of agent used is easily determined by use of curves or tables. The adjustment of agent to flow of pulp through the flotation section is made by varying the number and size of the cups attached to the disk.

Calumet & Hecla Mining Co.

During the year ended Dec. 31, 1918, the Calumet & Hecla Mining Co. produced 67,968,357 lb. of copper. The production costs and earnings statement, as given in the annual report, is tabulated as follows:

PRODUCTION COSTS OF CALUMET & HECLA MINING CO. FOR YEAR ENDED DEC. 31, 1918

	Pounds	Per Lb.	
Mining and mine taxes	58,722,969	@ 15.01c.	$8,816,924.28
Reclamation	9,245,388	@ 7.20c.	665,600.39
Totals	67,968,357	@ 13.95c.	$9,482,524.67
Smelting, refining, Eastern offices and corporation taxes		Per Lb. 1.76c.	$1,201,831.71
Depreciation and depletion		5.34c.	3,626,314.07
Production cost of	67,968,357	@ 21.05c.	$14,310,670.45
On hand Jan. 1, 1918	17,967,381	@ 12.60c.	2,263,786.84
Total	85,935,738	@ 19.29c.	$16,574,457.29
Delivered in year	78,367,248	@ 19.29c.	15,114,714.63
On hand Dec. 31, 1918	7,568,490	@ 19.29c.	$1,459,742.66

EARNINGS STATEMENT

	Pounds	Per Lb.	
Received for copper delivered	78,367,248.00	@ 24.28c.	$19,027,052.27
Costs of copper delivered:			
Production cost, as above, at 19.29c.	$15,114,714.63	.....	.....
Selling and delivery costs at 0.50c...	392,582.58	19.79c.	15,507,297.21
Gain on copper delivered	.....	4.49c.	$3,519,755.06
Miscellaneous receipts	$2,679,791.23		.....
Miscellaneous charges	1,250,350.22		1,429,441.01
Total net income	.....		$4,949,196.07
Dividends paid	$5,500,000.00		.....
Reserve (estimated) for 1918:			
Federal taxes	600,000.00		6,100,000.00
Balance	.....		$1,150,803.93

Tons of rock treated aggregated 2,876,392, at a mine cost (excluding construction) of $3.07 per ton. The rock yielded 58,722,969 lb. refined copper, or 20.42 lb. per ton of ore mined. Of this production 1,547,603 tons came from the Conglomerate lode, at a mine cost of $4.09 per ton, and yielded 43,329,816 lb. copper, or 28 lb. per ton, and 1,328,789 lb. came from the Osceola lode, at a mine cost of $1.88 per ton, and yielded 15,393,153 lb. copper, or 11.58 lb. per ton.

Mine development on the Conglomerate lode included 33 ft. of shaft sinking, 7,149 ft. of drifting, and 3,659 ft. of crosscuts and foot-wall raises. On the Osceola lode, 10,192 ft. of drifting was performed.

Operation of the regrinding plants is illustrated by the following figures of tonnage treated and results obtained:

TONNAGE AND TREATMENT DATA

	From Mine	From Old Sands
Tons treated	530,657	715,007
Assay headings, per cent. copper	0.599	0.868
Assay tailings, per cent. copper	0.414	0.568
Pounds refined copper	2,243,022	4,776,302
Pounds refined copper per ton treated	4.23	6.68
Cost per pound, excluding smelting and selling, cents	6.75	4.33

The leaching plant operated satisfactorily throughout the year, with the following results:

Tons treated	1,005,015
Assay headings, per cent. copper	0.535
Assay tailings, per cent. copper	0.126
Pounds refined copper	8,035,156
Pounds refined copper per ton treated	8.00
Cost per pound copper, excluding smelting and selling, cents	7.71

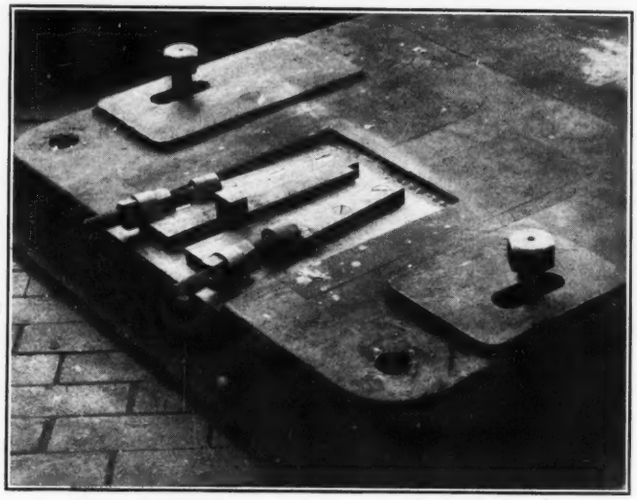
The results of operations of the reclamation plant for the year are as follows:

	Year, 1918	Since Starting
Tons tailings treated	715,007	2,173,009
Assay headings, per cent. copper	0.868	0.928
Assay tailings, per cent. copper	0.244	0.364
Pounds refined copper	9,245,388	25,316,296
Pounds refined copper per ton treated	12.93	11.65
Cost per pound copper, excluding smelting and selling, cents	7.20	5.99

Dividends paid by the company to the end of the year 1918 (including No. 186), amount to $150,750,000. Dividends received from subsidiary companies to the end of the period reviewed were as follows: Ahmeek, $5,533,640; Allouez, $1,127,500; Centennial, $166,000; Isle Royale, $411,734.50; Osceola, $3,629,002; and Superior, $100,200; total, $10,968,076.50.

An Adjustable Motor Anchorage

An adjustable motor anchorage which is used for the purpose of conforming motors to their bedplates is illustrated herewith. It is suitable for use on motors of 50 hp. or over and recently has been placed on the market by the Adjustable Anchorage Co., of Detroit, Mich. The device is simple, reliable and positive, and its application to motors equipped with magnetic clutches is of particular advantage, although it is useful



ADJUSTABLE ANCHORAGE FOR MOTORS

on motor driving belts. Heretofore motors have not infrequently been doweled in place. Any change in the situation of a motor so positioned is difficult, slow, and often entails injury or destruction to the concrete foundation. By means of this new device slight changes in the position of the motor may be readily and quickly effected, the only tool necessary being a suitable wrench.

Injury to Blasting Employees

BY A. L. H. STREET
Attorney at law, 820 Security Building, Minneapolis, Minn.

In an action to recover damages for death of a mine laborer in the Joplin district, due to an explosion of dynamite used by him in breaking boulders, it is held by the Missouri Supreme Court that a mine operator may be regarded as having been guilty of actionable negligence in permitting an inexperienced man to use dynamite under such circumstances, without proper instruction, not only as to the dangers involved in the work, but also as to how he should do his work to avoid such danger. (Batesel *vs.* American Zinc, Lead & Smelting Co., 207 *Southwestern Reporter*, 742.)

It is also decided that whether an employee is to be regarded as having been guilty of contributory negligence or as having assumed the risk of injury in such a case depends upon whether the peril encountered by him was so obvious that a reasonably prudent man would not, under the same circumstances, have undertaken the work, considering the injured man's experience or lack of it in such work.

Technical Training*

Special Knowledge Required by the Young Man Who Hopes Successfully To Meet the New Problems Which Have Grown Out of Recent Changes in Commercial and Industrial Activities

BY M. L. REQUA

TO THOSE young men who contemplate a career in the petroleum industry—or, for that matter, in mining of any sort or in the diversity of industries that have to do with engineering in all its multiplicity of forms—thorough technical education is today of greater value than at any time in the past. Tomorrow it will be still more valuable, and its value will increase as the years pass.

The reason is simple, if we will but stop to consider and analyze the events of the last century. A hundred years ago our mineral wealth was practically untouched; the great West was an unknown wilderness; the revolutionizing inventions based upon steam and electricity were undreamed of. We were in large part a pastoral and mercantile people, untrained in the sciences which now form so vital a factor in our daily life. The great fabricating plants of all kinds that now dot the landscape from Maine to California were then unthought of; the family spinning-wheel supplied the wants now cared for by the factory crammed with intricate machinery. The home-made tallow dip afforded the light now supplied by electricity, gas, and petroleum; and the horse transported from place to place the freight we now move by railroad and motor. The infinite and complex activities founded upon power have necessitated special knowledge, and that knowledge is now in large part being supplied by our colleges and universities through engineering courses.

Science, after all, is but the record of experiments, successful and unsuccessful, which have been co-ordinated, catalogued, and filed away for future reference. It is the index, the record, of the activities of the practical man whose pioneer efforts in the field, the factory, and the laboratory are made available as a guide to posterity. And because of the complexity of modern engineering in all its branches, its constantly widening scope and growing literature, it is becoming more and more important that the young man upon the threshold of his career shall be familiar with past failures and successes; to the end that he shall not waste his time in attempting experiments long ago undertaken by others, the records of which are available for the asking.

None of us, I am sure, would think of submitting himself to untrained hands if in need of a surgeon, nor would be knowingly commit his cause to one untrained in the law. The case of the youth about to enter the oil industry is to a great degree parallel—no one would think of giving him the job of drilling the well, producing the oil and transporting, refining and marketing it, unless he had first undergone a preliminary course of education, had served his apprenticeship. This apprenticeship may be served entirely in the field, but if it is served first in the classroom and thereafter in the field the result will, of course, be more satisfactory. And, given two boys equally endowed, the one possessing the technical education should not only far more quickly complete his practical apprenticeship, but he would in after years be more completely the master of his chosen subject.

And, again, the reason is not far to seek: he has mastered not only the theory but the practice of his business; he knows not only what to do, but—and what is perhaps equally important—why he does it. I know, of course, that there are great men who have risen to premier rank in their several professions without a college degree, but I think it may safely be said of them that they would have the sooner arrived, and would have saved themselves endless and laborious effort, if they had in the first place completed a technical course of training. The information slowly gathered in fragments here and there over the long years of practical apprenticeship could be far better mastered in four years of intensive training in college, where it is acquired in an orderly, co-ordinated, and complete way.

We must not fall into the error of believing that a college degree is a certificate of ability. Far from it. The world is well supplied with men possessing sheepskins whose services would be dear at any price. Without the requisite foundation of character, all the diplomas on earth will fail to make their possessor a man of value. Common sense, that greatest of all fundamentals, is often notable by its absence among highly educated theorists.

We are basing our discussion broadly upon the question as to whether or not a technical education is desirable for a young man about to embark in the oil business. In production, certainly, some geology as well as civil and mechanical engineering is of value. In transportation, mechanical engineering is almost a necessity: and in the refinery a course in chemistry is a prerequisite for any man who hopes to master the refining of petroleum in all of its branches and stand among the leaders of modern refining practices. I believe, too, that a salesman who knows something of the chemistry of oils, and who has served apprenticeship in a refinery, will, other things being equal, lead the way rather than follow the lead of others.

All industrial activities should be constantly progressing. Inertia is fatal. And he who would lead or be near the head of the procession must of necessity have technical education as the foundation of his activities. He may not acquire it in college; it may come through the slow process of years of practical experience, but it is none the less necessary; and if four years will serve to acquire the fundamental knowledge that it would otherwise have taken fifteen or twenty years to gather, is it not the part of wisdom to adopt the former course?

There are many young men who have already started out in their work without having had the opportunity to secure the necessary technical foundation. I believe that those who can would do well to spend a year or more at some technical school, and with that groundwork build the balance of the structure by home study.

*Reprinted from Sinclair's Magazine, June, 1919.

It does not follow that, simply because work has been commenced before the college course has been undertaken, the time has gone by. I know several men who have abandoned work for the classroom and who have afterward returned to their business career far better equipped for the struggle.

The future has still in store many great discoveries in perhaps all lines of engineering endeavor. Certainly the end of invention has not yet been reached; there is much yet in store for the student who would venture upon pioneer expeditions into the realm of science. Learned mathematicians of the past demonstrated conclusively that the flying machine was an impossibility; and yet today we do fly. Petroleum may yet be made into edible fats; the heavy-gravity oils may be metamorphosed into 80 per cent gasoline; the impossible, so-called, may in years to come be found to be, after all, absurdly simple.

It is a wonderfully brave man—or an ass—who confidently outlines the limits of possible future advancement in the realms of science. I think that about all we can say with assurance is that the future holds possibilities as yet unfathomed.

Technical Training Now Essential

Within the life of two generations conditions have been revolutionized. It was not particularly necessary for our grandfathers to be technically trained. Power, as supplied by steam, petroleum and hydro-electricity, was virtually unknown; and the myriad inventions that today depend upon power were undreamed of. Our children have other days to face, wherein the activities of the time will rest largely upon technical skill. He who would be a part of those activities must know some phase of them, and know it well. A mere smattering of knowledge no longer suffices.

The man who is sought after today is the man who knows his subject thoroughly and who brings to the task not alone adequate training but common sense, honesty, and integrity, loyalty, and untiring energy. For such as these, opportunity beckons with insistent gesture. That it rewards only those who hold college degrees would be, of course, an absurd statement; but, all things being equal, the man with the technical training has an advantage that will be found difficult to overcome by those not so fortunate.

Edward A. Caswell Dead

Dean of Lead Industry, and for Years the Country's Leading Lead Statistician, Expires Suddenly At West Chester, Pa.

EDWARD ALEXIS CASWELL died suddenly on June 25 at West Chester, Pa. In his death the metal industry lost one of it best-known and most-respected figures. For nearly half a century he had been prominently identified with the lead business of the United States, as a broker and statistician, and for many years there was no one better known in those capacities.

Mr. Caswell was graduated from Yale in 1866, and immediately afterward went to Europe, where he remained for six years, studying, traveling, and seeking restoration to health. During a part of that time he was correspondent to newspapers in this country. Returning to the United States in 1873, he engaged in business as a metal broker in New York, and continued in that business up to the time of his death. In December, 1912, owing to his advanced years, Mr. Caswell incorporated the business under the name of Caswell & Starke, Inc., and during recent years he had not been very active at the firm's office.

Mr. Caswell was born in New York in 1844. His father was Nathan Caswell, a descendent of Peregrine White, and his mother was Mary Lincoln (Bowman) Caswell. He was married to Emma Fairbanks in Geneva, Switzerland, in 1872. His wife died in New York City in 1883, leaving two children, a son and a daughter.

From Mr. Caswell's early participation in metal-industry affairs up to about the beginning of this century he was one of the recognized pig-lead statisticians in the United States. In earlier years he was, in fact, the only one; and the possession of any statistical working knowledge about the industry was due to him. In the course of time, however, as statistical work was taken up by others, Mr. Caswell gradually dropped it as being no longer a necessary effort on his part.

Mr. Caswell was a member of the Century Association and the Yale Club. In addition to his business, he wrote occasional musical and art criticisms for the New York daily papers. He was one of the charter members of the New York Metal Exchange.

Mr. Caswell was highly esteemed by all who came in contact with him, and the number of his staunch friends is legion. The men who were most closely associated with him in business unite in saying that he never did anything dishonorable, nor did he ever seek an unfair advantage. He was a true and loyal friend of all. With his passing away, the lead business of the United States may be truly said to have lost its dean.

Expiration of Flotation Patents

According to the *Boston News Bureau* of June 23, 1919, the following statement recently appeared in print on behalf of the Butte & Superior company in its legal controversy with Minerals Separation, Ltd:

"The Butte & Superior Mining Co. states it is prepared to continue the use of permissible quantities of oil until the expiration of the (Minerals Separation) patent in November, 1923, (after which time the use of the process with any quantity of oil will be free and open to the public), or to adopt one of the more economical methods now coming into use."

The article continues to the effect that counsel of Minerals Separation was asked for a statement concerning the patent expiration referred to, and the following reply was received:

"The fact is that the patent which was adjudicated by the Supreme Court in the Hyde case and in the Butte & Superior case ends its seventeen-year term on Nov. 6, 1923, and the public will then be free to the use of the invention disclosed and claimed in that patent. There are, however, many other flotation patents owned by the Minerals Separation North American Corporation which have considerably longer periods to run, such, for example, as the basic patent covering the use of soluble frothing agents, which expires in June, 1927; the aromatic-hydroxy-compounds patent, which expires in 1931 (both of which patents have been declared valid by the Circuit Court of Appeals of the Third Circuit), and the essential-oils patent (which necessarily includes pine oil), which expires in 1930."

Recent Metallurgical Progress*

Flotation Has Revolutionized Concentration—Zinc Metallurgy Has Advanced, Though But Little, in Smelting—In Copper, Reverberatory Practice and Ammonia Leaching Are Chiefly To Be Noted

BY HUGH K. PICARD
President of the Institution of Mining and Metallurgy

IN REGARD to metallurgical advance during the last few years, it will probably be conceded that the practice of flotation has brought about greater progress in metallurgy than any other single invention. At the inception of the froth flotation process in 1905, oils, such as oleic acid (then deemed to be insoluble), were used. As careful analysis showed the mineral so frothed to be intimately associated with the insoluble oil employed, the impression was gained that this had uniformly coated the particles which had been floated, and that the air-bubbles had become attached to such oiled particles. As the amount of oils used was relatively minute, say two pounds to the ton of ore, though the aggregate surface of the particles oiled is enormous, calculation showed it to be questionable whether an oil could be distributed *qua* "oil" in such extreme tenuity and still retain its original physical properties.

PROCESS BECOMES KNOWN AS FROTH FLOTATION

With the discovery, about four years later, that other and wholly soluble frothing agents were found equally as and sometimes even more efficacious, the conception that oil was primarily essential to frothing was necessarily modified, and the process became more widely known as that of froth flotation. With later discoveries as to the partial solubility of essential oils, of the beneficial effect of certain insoluble oils in "stabilizing" the froths and of sub-aëration procedure, the elimination of any need for pulp-heating, or in many cases for acidification, together with the use of alkaline circuits, and like expedients, modern flotation has made remarkable advances.

Broadly speaking, the essential conditions for effective flotation appear to be that the material to be floated must be capable of flocculation, whereas that not to be floated must be brought as nearly as possible to the reverse state. This is achieved by the addition to the ore pulp of reagents which by absorption or adsorption at the surfaces of the various particles increase such differentiation. Acids, alkalis, and certain alkaline salts act in the direction of wetting the gangue by water more profoundly, producing a deflocculation effect and the adsorption or absorption of a minute amount of an immiscible oil at the mineral surface renders this still less capable of being wetted by water, and thus stabilizes a mineral-coated bubble in water.

The water-soluble portion of an oil, or a water-soluble substance such as cresol or amyl alcohol, reduces the tension of water, and thus permits the latter to form an extended froth surface for occupation by the less water-wetted floatable mineral. Certain oils may thus play a dual part in flotation. Variations in ore constitution—both physical and chemical, in the nature of the water, in choice or limitation in reagent, and in local conditions generally—are so wide that each one will present a flotation problem of its own, requiring individual study. Where the factors are so varied flotation must in large degree remain an art, as well as a growing science. This condition, however, governs applied science generally, and metallurgical processes form no exception to the rule.

I understand that contributions to the more scientific aspects of flotation may be expected soon, which will, no doubt, go far to elucidate the fundamental principles on which the process is based.

Since the outbreak of war, flotation methods have been widely, indeed almost universally, adopted. During this period, the greatly extended use of this process in the United States is the most notable feature, and it is hardly too much to say that concentration practice has been revolutionized. In addition to the increased recoveries of mineral due to the ability to deal effectively with slimes, its adoption has led to a general simplification of concentration procedure, with a corresponding reduction of working costs.

In modern installations, such as that of the Inspiration Consolidated Copper Co., Miami, Ariz., where the plant was specially designed for flotation, the current practice is to limit the units to the smallest number possible. At this mill, the ore, first crushed by disk crushers, is passed to tube mills, working in closed circuits. The pulp is then immediately sent to flotation units, with the consequent elimination of all intermediary steps in the concentration. The re-treatment of any middling products and the enrichment of the primary concentrates are also effected by flotation, resulting in a simple flow sheet.

Froth flotation has developed the use of settlers and vacuum filters, which are now indispensable units in concentration plants adopting this process. The settlers are in some instances employed for the re-utilization of plant water and in others for the thickening of concentrates prior to vacuum filtration. Their usual size is from 30 to 50 ft. in diameter, but in some instances settlers of over 200 ft. in diameter are in use. The shallow "tray" settler is also employed where the physical character of the ore permits. The trays consist of units 3 to 4 ft. in depth superimposed on a common shaft to economize space and secure increased capacity.

Similar progress has marked the evolution of the flotation units themselves. In the M. S. type, for example, the driving gears have in some instances run continuously for over three years. These units are self-regulating, the supply of reagents being automatic, so that in practice it is not uncommon to find one man per shift operating units dealing with between 3,000 and 4,000 tons of ore per twenty-four hours.

Everywhere the tendency is toward the elimination of hand labor. Thus, besides ores, the concentrates and tailings are handled by settlers and belt conveyors, and the grouping of all units is designed with the object

*Excerpted from the presidential address delivered at the annual general meeting of the Institution of Mining and Metallurgy, in London, May 8, 1919.

of reducing to a minimum labor, space, and construction cost. The result has been a reduction in treatment cost which, in many instances, has rendered obsolete the best of the older gravity-concentration systems.

Figures Show Advantages of Flotation

Comparative figures as to the advantages of flotation may be of interest. The total tonnage of ore treated by water concentration at the Anaconda plant from February, 1902, to December, 1915, was approximately 36,000,000 tons, carrying 1,250,000 tons of copper, of which the actual recovery was approximately 900,000 tons. In 1916 flotation was installed, from the results of which it is estimated that had it been used during the earlier period 175,000 additional tons of copper would have been saved, capable of realizing, less cost of treatment, a further profit of nearly £8,000,000. In 1913, when water or gravity concentration had attained perhaps its high-water mark of efficiency, the five largest porphyry copper mines in the United States produced approximately 162,000 tons of copper, but discarded 83,000 tons in tailings, the average recovery of copper at these mines being about 66 per cent. Had flotation been employed, it is now demonstrable that their increased recovery for that year alone would have exceeded £3,500,000.

In its turn, however, flotation has introduced new smelting problems, mainly due to the fineness of the material to be handled. The International smeltery, at Miami, which now represents the latest copper-smelting practice in America, has been specially designed to deal with this type of concentrate. Hand labor here has also been practically superseded by mechanical appliances; specially designed cars handle the concentrates and facilitate their loading and unloading, prior to their passage to the roasting plant. The roasters are fired either by oil or coal dust, the latter having now proved the more economical. The Cottrell process here becomes a necessary adjunct, preventing dust losses with practical completeness. Again, progress in one department of metallurgy has imposed conditions which have led to improvement in another; thus, the cost of smelting the fine concentrates, originally so difficult to handle, is now reduced to between 5s. and 6s. per ton of charge.

Though the theoretical principles underlying flotation are still unsolved, progress in this direction is being made, and it is one of the most remarkable features of this process that its use has been so greatly extended, although its full scientific basis is yet unestablished. Callow, whose contribution to the technics of the art deserves special mention, calculates that with four different oils, three oil percentages, two pulp densities, and two changes of temperature, the possible commutations are no less than 59,284. This gives some idea of the difficulty experienced in arriving at the effect of any given change of conditions, but in spite of this over 400 flotation plants have been installed in the North American Continent alone.

Little Improvement in Zinc Smelting

Passing to the metallurgy of zinc, there has not been marked improvement of first importance in smelting during recent years, though general advance in matters of detail may be recorded. The problem of the mechanical roasting of the ores cannot yet be considered as completely solved, especially for the more refractory types, such as Broken Hill concentrates, which form so large a proportion of the world's supply of raw material. Though improvement has been effected in this direction, as exemplified by the Ridge and Spirlet furnaces, it is significant that in the latest zinc works to be erected in this country the management has adopted the hand-rabbled Delplace furnace as being the type best suited to its requirements. These works, situated at Avonmouth, are being constructed by the National Smelting Co., and are designed for an ultimate output of 50,000 tons of zinc per annum. When completed, with extensions of other existing works, they should go far toward establishing the industry in this country on a much sounder basis than existed before the war.

No effort is being spared to make the Avonmouth works thoroughly efficient and up to date. The general lay-out is well designed, and provision is made for future extensions. The pottery has a capacity of 45,000 retorts, and is arranged for convenient handling in and out. Two hydraulic pot presses are to be installed (one of which is already erected), which will supply the retorts for the sixteen retort furnaces now planned. These are of modern gas-fired type, the retorts being arranged in four rows, back to back. The air is preheated in regenerative chambers under the furnaces. These chambers are protected from injury due to slag from broken pots by the interposition of a layer of chrome-iron ore between the regenerators and the retort chamber. Five gas producers are provided for each pair of furnaces, two being in regular use for each furnace, the fifth being a spare one which can be turned on to either furnace, as may be required.

Though Delplace furnaces are being installed for roasting, the management is erecting one of special design, upon the results of which future additions will depend. The former are of large type, having six muffled hearths with eighteen sections, and should be capable of dealing with twenty tons of raw concentrates per day. Special care has been taken in the design to insure easy renewals of the hearths as required.

The acid plant, of platinum "contact" type, was originally built by the government, and has been used for the manufacture of sulphuric acid from Sicilian sulphur. With the necessary additions for cleaning the roaster gases from arsenic and other objectionable material, this plant will be available to deal with the sulphur dioxide evolved from the twenty roasting furnaces that it is purposed to install.

In view of the present high cost of both labor and material, and of the improved extraction now called for, much attention has lately been given to the question of treating retort residues for their metallic contents, both as to zinc still contained, and other metals such as lead and silver, if present. It has been proposed to blow such residues on Wetherill grates, but this yields a mixed product of zinc oxide and lead sulphate and affords only a partial elimination of the silver. Other objections are the inferior quality of the product (due to a certain amount of fine grit being carried over with the fumes), and if silver be present the blown fume acquires a pinkish tint, rendering it unsuitable for paint purposes. Further, the silver, both in the fume and the ultimate residues, is lost.

In the absence of silver, a market exists for the zinc oxide-lead sulphate product, if free from grit and carrying about 20 per cent of lead. Such a mixture makes a paint of covering power superior to pure zinc-white,

besides being cheaper. For ores of a less complex character, "blowing" the residues offers fair possibilities, and it has even been proposed to modify the usual distilling practice in the direction of recovering only the more easily distilled part of the zinc, calling for the employment of a smaller amount of reducing coal and leaving a richer zinc residue for blowing. Such a procedure would increase the capacity of the distilling furnace and result in longer life of retorts, as it would not be necessary to submit them to the high final temperature required to drive off the last units of zinc.

Electrolytic Zinc Process Will Be Established

Wet processes for zinc extraction, with the subsequent recovery of the metal by electrolysis, have now become firmly established. Ashcroft's pioneer work in this direction will be remembered. The conditions necessary for success, notably roasting at a low temperature to avoid the formation of insoluble ferrite, and the subsequent perfect purification of the solution, are now well understood, the latter condition being demanded by the necessity for keeping the deposited zinc in a passive state to prevent re-solution. As a necessary consequence, electrolytic zinc will always be highly pure compared even with the redistilled zinc producible from retorted metal.

Much discussion has taken place as to the possibility of the electrolytic process displacing the older method; but it seems probable that for some years both processes will survive, and that local conditions with regard to the nature of ore, power cost and facilities, and other factors of production will determine which method shall be adopted for any particular case. It may be said for the electrolytic process that it certainly permits the utilization of low-grade and complex zinc ores which cannot be made available to the retort process. As an example, the Consolidated Mining and Smelting Co. is treating ores by this method at Trail, which assay as low as 20 per cent zinc and carry 14 per cent lead. Further, combination dry-and-wet processes are likely to develop in which the zinc oxide (and lead if present) are concentrated as a "fume" for subsequent treatment by solution of the zinc, followed by electrolysis. Such methods have the advantage of yielding a zinc solution which requires the minimum of purification, at the same time leaving other metallic contents in a form recoverable by smelting.

At Anaconda, Laist has proceeded in a reverse direction, by first extracting roasted flotation concentrates with acid, electrolyzing the purified solution, and treating the residues by volatilization in a reverberatory furnace, the contained zinc being recovered as oxide. According to recently published information, Laist no longer recovers the zinc by volatilization, confining this operation to the saving of the lead, the zinc passing into the slag. How far this is due to more perfect original extraction of the zinc in solution in the previous operation is not stated.

American Metallurgists Chief Contributors

These developments are due in large degree to the work of American metallurgists, who have at their disposal large supplies of ores of varying character, which offer scope and opportunity for special methods of treatment. But in this country, also, zinc has been regularly produced by electrolysis from ores, though on a smaller scale. Given, however, equal opportunity, we may certainly claim to possess the necessary technical knowledge to compete with foreign producers.

The war brought about a large demand not only for the highly pure electrolytic zinc of 99.95 per cent grade, but also for metal of 99.9 per cent purity, obtainable by the redistillation of ordinary brands, and even of hard spelter, which contains from 90 to 92 per cent zinc, the remainder being mainly iron. The preferred method in this country was devised by Fricker, who distills the metal in vertical-closed crucibles provided with connecting pipes leading into a brick condensing chamber common to a number of pots, generally eight. The lead and other impurities are prevented from passing over with the zinc vapor by covering the surface of the molten metal with a floating filter of crushed coke or similar porous material. By this process large quantities of refined metal have been produced for cartridge brass and other purposes.

How far the demand for high-grade zinc will persist for ordinary commercial uses is uncertain. For most alloys containing a substantial percentage of zinc, as also for galvanizing, ordinary brands of spelter are sufficiently pure. Hence, consumers are not likely to pay the higher price demanded for "purity" metal.[1] The latter will therefore have to compete with G.O.B., and producers may perhaps be forced to accept a price only greater in proportion to the higher unitage of the purer product.

Before leaving the subject of zinc metallurgy, reference may be made to the manufacture of zinc oxide in this country. Before the war practically the whole of our requirements were met from Continental and American sources. Indeed, our secondary products were, in some cases, bought by German firms, exported to the Continent for treatment, and the zinc oxide product again sold to us. War conditions have since brought about the establishment of a home zinc-oxide industry; and, as in other cases, we now produce this material of a quality equal in all respects to that hitherto imported. Works capable of producing fifty tons or more per week are running regularly, and, given reasonable protection against unfair competition, there seems to be no reason why all of our requirements should not hereafter be met from home sources.

The oxide is manufactured by distillation of hard spelter and scrap, with subsequent burning of the volatilized metal to oxide, which is collected in a baghouse plant in the usual way. Technical details as to pipe, arrangements, fan capacities, and other operating factors have been worked out, and the conditions necessary for the production of the highest quality product have been established. No doubt there will still be competition from American oxide, produced directly from ore, owing to the lower cost of the raw material employed. This oxide, though of inferior color, is suitable for many purposes, such as rubber filling; moreover, it possesses the advantage of high density. Oxide production from ores and residues, though not yet established in this country, is being investigated, and there is reason to expect that this may eventually prove successful.

In South Wales zinc dust ("zinc blue") has recently been manufactured direct from metallic scrap, and a product obtained which is far superior to that derived as a byproduct from the retort process. The latter

[1]The galvanizer would prefer pure zinc if obtainable at a reasonable price, as a more durable product results from its use.

usually contains about 85 per cent of active zinc, whereas the former carries not less than 95 per cent. The demand for high-grade zinc dust in the dyeing industry is large, and owing to its superior reducing value it should have a good outlet in gold precipitation.

The prepared fume is screened in a flour miller's bolting machine. Owing to its granular character, no difficulty is experienced in screening. The product, though excessively fine, is uniform in size of particle and free from dust; under the microscope each grain is seen as a brilliant metallic sphere. A word may be said as to the perfection of the bolting machine for screening fine powders. This has been developed to meet the stringent requirements of the corn-milling industry, and, if better known, would no doubt find application in screening dry crushed ore.

A wider general knowledge of the practice of industries other than our own would, I believe, lead to the discovery of many appliances which could be adapted to our special needs. For example, the filter press was well known to the potter before its value was recognized in ore treatment. He has from our point of view the worst possible type of clayey material to filter, and, in addition, contamination by iron rust must be avoided. Hence he adopts a press with wooden frames. We could perhaps reciprocate by introducing to him the vacuum filter and pulp thickeners.

Copper Metallurgy Has Progressed

For developments in the metallurgy of copper we naturally look to the United States. Thanks to the publicity given to progress in the States, and to excellent technical publications, we have been made familiar with recent advances, and it thus becomes unnecessary to refer to them in detail. Among such, reverberatory practice (due to the ever-increasing amount of flotation concentrates to be smelted) may be mentioned. In this connection the increased throat area, with correspondingly larger burners for oil or coal-dust firing, resulting in largely increased output per furnace, should be noted. The El Paso 130-ft. furnaces, burning oil, have reached a daily capacity of over 960 tons, with a consumption of 0.61 bbl. of oil per ton. Leaching of oxidized copper ores by ammonia, so often suggested, has come within the domain of practical metallurgy. For example, it is reported that the Calumet & Hecla Mining Co., in a plant treating 2,000 tons of tailings per day, is recovering copper at a total cost of 6.25c. per lb., with a loss of only 1 lb. of ammonia per ton of ore. Further developments have also taken place in acid-leaching plants, in connection with which A. W. Halin's process deserves mention. He passes the acid solution through a number of ore charges until the solution becomes neutral. It is then delivered to a tank containing fresh ore, whereby the ferric iron is precipitated, whence, after acidification, the solution passes to the electrolyzing plant for precipitating the copper. The treatment of ore in heaps by leaching, following Rio Tinto practice, is also being extended in America.

The metallurgy of gold, in so far as it relates to the recovery of the metal from its ores, shows general improvement, but nothing of first-rate importance except perhaps Crow's method of precipitating cyanide solution under reduced pressure. He shows that the air dissolved in the solution has, owing to the different coefficients of absorption, a composition of 35 per cent of oxygen and 65 per cent of nitrogen, and consequently is a more active oxidizing agent than air of normal composition. He points out that in weak cyanide solutions, consequently with a minimum of hydrogen being generated, the oxidizing action of the dissolved oxygen largely neutralizes the reducing action and may even overcome it. In normal practice this is met by adding lump cyanide at the head of the precipitation box, with consequent increased consumption of both cyanide and zinc. By the adoption of the vacuum process this practice is unnecessary and extraction may be effected with weaker solutions, resulting in savings in all departments, including the production of a purer bullion. The Portland Gold Mining Co. reports a saving of $30,000 a year in zinc and cyanide in a plant treating 2,000 tons of ore per day. It is interesting to note that G. T. Hansen claims similar advantages by heating the solutions to 170 deg. F. before precipitation.

Flotation of Gold Ores Has Restricted Field

Concentration of gold ores by flotation is making progress, but the field for this process is somewhat restricted, owing to the general high efficiency of the older methods. At Cobalt, flotation has replaced gravity concentration, though at the Nipissing mines this process has been rejected, not on account of its inefficiency, but because of the difficulties in subsequent treatment of the concentrates. On complex gold-silver concentrates involving further treatment, the advantages of flotation compared with ordinary concentration followed by cyanide are not so manifest. The value of flotation as a means of increasing the world's output of gold lies, rather, in improved recovery of base metals, such as copper, with which gold is so commonly associated.

In the metallurgy of lead, also, recent advances seem to be in detail rather than in fundamental improvements. In the stress of recent years there has been small opportunity of developing new processes in industries that are well established on recognized lines, such efforts being rather devoted to specialties called for by the art. Mention, however, may be made of progress in hydro-metallurgy, as applied to oxidized lead ores. This has been limited to brine treatment, with or without the addition of sulphuric acid to carbonate and sulphate ores. This process has been tested in America, as well as in North Wales, where a small plant was working until the difficulties of obtaining supplies caused a temporary cessation of operations. In this case the material to be treated consisted of an extensive dump of blende and lead sulphate slimes.

Vanner concentration yields a mixed product of no value until further separated. This is effected by agitating the concentrates with hot saturated brine at 70 deg. C., whereby the lead sulphate is completely dissolved, with, of course, the equivalent formation of sodium sulphate. The presence of this salt in growing proportions interferes with the solubility of the lead sulphate, and it must therefore be removed by the addition of the equivalent amount of calcium chloride. The lead solution is filtered from the blende-calcium sulphate residues, and precipitated with slaked lime, re-forming a portion of calcium chloride. About 50 per cent of the chloride is regenerated, the rest of the chlorine being precipitated with the lead as oxy-chloride. The blende-calcium sulphate residues are then retreated on a vanner, which effects perfect separation of the easily removed flocculent sulphate, leaving a

salable blende concentrate. The chief objection to the process lies in the chloride present in the lead precipitate, involving volatilization loss in smelting, but this may be overcome by precipitating the lead by electrolysis, using soluble iron anodes. This process is limited in its usefulness by the relatively small quantity of material available and by its inapplicability to silver or gold contents. It may, however, develop in the direction of the treatment of low-grade sulphide ores, after a sulphating or chloridizing roast at a temperature low enough to prevent the volatilization of the lead chloride.

In the province of general metallurgy the increasing use of the Cottrell process deserves special mention. As an example of painstaking research in developing a practical process from a long-known but unused scientific fact, it has few equals. We have to go back to 1870 to the work of Dr. Tyndall for the first disclosure of the phenomenon on which the process is based. This was further examined by Frankland, Lord Rayleigh, and Oliver Lodge; but for the useful application of the principles involved we had to wait for Dr. Cottrell. He first applied the method to depositing sulphuric acid mist produced in the contact process, and it is still being used for this purpose. It is satisfactory to report that the merits of the invention have been recognized in this country, the first plant to be erected here in 1917 being at one of the government acid plants. It is also in use here for the precipitation of fumes from metallurgical works, following established practice in America; and its further extension in this country seems certain. The advantages of the process are far-reaching. Not only are valuable products recovered, but agriculture in the neighborhood of the operations is saved from serious damage. We are glad to congratulate Dr. Cottrell on receiving the Perkin Medal as a recognition of his valuable services to industry.

Labor Troubles at Butte

Shorter Workday and Wage Increases Sought by All Crafts at Mines—Anaconda Pay Office Dynamited —C. F. Kelley in Butte—Local Merchants Called Profiteers

BUTTE CORRESPONDENCE

LABOR controversies are occupying the center of the stage in the Butte district. All crafts engaged at the mines either have made demands, or will do so soon, asking for a shorter workday and material wage increases, which demands at this time, it is expected, will be rejected by the operators, in view of the high mining costs and market conditions.

C. F. Kelley, president of the Anaconda Copper Mining Co., arrived in Butte tonight (July 7) to take personal charge of the labor situation, and conferences with local mine officials will be held on July 8 to set dates for meeting with representatives of unions. Mooney sympathizers and the I. W. W., by a system of personal picketing, up today had succeeded in inducing about 35 per cent of the working force of miners in the district to stop work, although many of these have quit in line with the program to enforce demands for higher wages and a shorter workday. The miners themselves as yet have presented no formal demands, despite the fact that all other crafts have done so.

The downtown pay office of the Anaconda company, which is remote from the mines, was dynamited Sunday. This is regarded as the work of a fanatic. Little damage was done.

The metal crafts, comprising all classes of mechanics employed at the mines, demand $8 per day for journeymen and $7 for helpers, with a 5½-day week, with overtime at double pay for Saturdays and Sundays. These crafts now are receiving $6 for journeymen and $5.75 for helpers. Carpenters ask for similiar increases. Smelter men's demands are based on what is purported to be a Government report showing that the cost of living has doubled since 1914, and a wage increase which would measure correspondingly is asked. This would not necessarily mean doubling the present pay of smelter workers, as their wages have been increased materially since 1914. The smelter men's organization embraces most of the crafts employed at the reduction works. Demands of the miners had not been received up to the time this is written.

The unions also had asked the companies to take steps to lower living costs by establishing company stores operated at cost. The complaint is widespread against alleged profiteering of Butte merchants, and the unions declare that it is impossible to live in Butte under the present expenses, even under what the new scale demanded would give them.

One factor in favor of the operators is that the greatest number of miners are on what is known as a contract basis. That is, they are paid for what they do, and their remuneration is running from $6 to $12 daily. These men are not in favor of striking, particularly as they either are married or have dependents. The I. W. W. and radicals long ago were weeded out of the properties to a great extent, with the single men giving way to the married or those with dependents, thus leaving the more conservative of the miners.

There is apparently a disposition on the part of the unions to wait and see what the Anaconda company is disposed to do before deciding upon radical action, as word has gone forth that the company is not opposed to suspending mining operations altogether for a period, in view of the huge copper surplus.

Despite unofficial word that the operators were not inclined to grant wage increases, a feeling of optimism is dominant, and the sentiment obtains that wage increases will be had, particularly as the copper market is showing signs of recuperation to an extent which will show a profit under present conditions.

A Department of Public Works

New Bill Introduced in Both Houses To Reorganize Interior Department—Will Bring All Engineering Activities of Government Into One Department

FAR-REACHING changes in the executive machinery of the Federal Government are proposed in bills introduced in each house of Congress on June 25. The Federal Department of the Interior will become the Department of Public Works, if the legislation proposed is enacted. The main idea is to assemble all engineering activities of the Government in one department.

Such bureaus of the Interior Department as are non-engineering in character are, under the terms of the

bill, to be placed under the jurisdiction of appropriate departments, and engineering bureas from other departments are to be included in the Department of Public Works. The bill proposes that the Patent Office be removed from the Interior Department and placed under the Department of Commerce. The Bureau of Pensions is assigned to the Department of the Treasury. The Bureau of Education and the Bureau of Indian Affairs are transferred to the Department of Labor, with the proviso that the engineering and construction work and the land and mineral surveys now performed under the direction of the Bureau of Indian Affairs are to be prosecuted under the Department of Public Works.

On the other hand, the Department of Public Works is slated to absorb the Supervising Architect's Office of the Treasury Department, the Construction Division, River and Harbor Improvements, Mississippi River Commission, and California Debris Commission of the War Department, the Bureau of Standards and the Coast and Geodetic Survey of the Department of Commerce, the Bureau of Public Roads, and the Forest Service of the Department of Agriculture.

The bill provides that the Secretary of Public Works "shall by training and experience be qualified to administer the affairs of the department and to evaluate the technical principles and operations involved in the work thereof." The measure accepts from the foregoing provision the Cabinet officer who is at the head of the department at the time of the passage of the bill.

Four assistant secretaries, each to be paid $7,500 per annum, are provided and their duties outlined. One assistant secretary is to have administrative jurisdiction over all matters of engineering design and construction. Another is to have charge of architectural design and construction. The third is to have jurisdiction over all scientific work and surveys, and the fourth is to be in immediate charge of all land and legal matters. The assistant secretaries are charged with the duty of co-ordinating all activities of the department.

An important feature of the bill is the proviso that engineer officers of the U. S. Army detailed on non-military work are to be assigned by the Secretary of War to like duties under the new department, for not over two years. This enables the Secretary of Public Works to make gradual transfer of improvements and instrumentalities to civil administration without detriment to public interest. Members of the Corps of Engineers may, under the direction of Secretary of Public Works, be detailed by the Secretary of War to temporary duty in the new department for such instruction, training, and experience as desired.

The bill was introduced in the upper house by Senator Wesley L. Jones, of Washington, and in the lower by Representative Frank C. Reavis, of Nebraska.

June Pig-Iron Production

Pig-iron production during June was 2,114,863 gross tons, or an average of 70,495 tons per day, as compared with 2,108,056 tons in May, a thirty-one-day month, according to *Iron Age*. Ferroalloy production amounted to 14,254 gross tons, of which about 70 per cent was ferromanganese. The estimated capacity of the 200 furnaces active July 1 is 71,700 gross tons a day, as compared with 195 furnaces, rated at 68,600 tons, active June 1.

Cornerstone Laid for Assay Office In New York

Carter Glass and W. G. McAdoo Have Chief Parts in Ceremony at Site of New Building In Wall Street

THE cornerstone of the new eight-story building that is to house the United States Assay Office in New York was laid on July 1 with fitting celebration. The ceremony, taking place at noon in the heart of the financial district, was witnessed by many thousands who filled the adjoining streets.

Vernon M. Bovie, superintendent of the Assay Office, was in charge of the ceremonies, and after a brief opening address resigned his position as chairman to Mr. McAdoo, who in a short speech introduced the Secretary of the Treasury. Mr. Glass, speaking briefly, confined his remarks chiefly to the position which the United States occupies in the world and set forth the steps by which it has been brought to its present high place.

Following the addresses, Mr. Glass and Mr. McAdoo participated in the actual work of laying the cornerstone, and with a silver trowel designed and cast in the local Assay Office spread at the base of the huge marble block the mortar which will hold it in place.

Calumet & Hecla Increases Forces

HOUGHTON CORRESPONDENCE

The Calumet & Hecla and subsidiary companies announced on July 7 that all underground workmen would be re-employed. This means that 3,000 men will return to work in the mines. Copper output will not be increased beyond 50 per cent of normal, but the amount of underground development work will be augmented. This event presages the turn in the copper-metal situation as viewed by the leading Michigan copper producers.

West Virginia Well Down 7,579 Feet

WASHINGTON CORRESPONDENCE

Evidence sustaining the temperature hypothesis of a cooling globe has been obtained by the U. S. Geological Survey in the large number of thermometer readings made during the sinking of a well near Valley Falls, W. Va., to a depth of 7,579 ft. The temperature near the surface was 52 deg., whereas at a depth of 7,500 it was approximately 170 deg. A slight reduction in the steepness of the gradient is noticed below 6,500 ft.

The well was designed for a test of the Clinton sand on the prominent geological arch, which is deeply cut by a river at the point where the well was put down. It was remarkable for the fact that it was dry and no casing was used below 2,000 ft. Caving started near the bottom of the well, however, and the drillers were forced to give up their attempt to reach a depth of 8,000 ft. The log of the well is being studied by the State Geologist of West Virginia.

The well was bored by the same company which put down a Goff well near Clarksburg, in northern West Virginia. That well, at the time of its drilling, about nine months ago, was the deepest well in the world. The record prior to that time had been held by a boring at Czuchow, in Silesia, which was 7,349 ft. deep.

Embedded in the stone was a copper box containing the customary documents, coins and other mementos. An inscription on the block read: "William G. McAdoo, Secretary of the Treasury; Raymond T. Baker, Director of the Mint; York & Sawyer, architects; James A. Wetmore, supervising architect; MCMXVIII."

The new Assay Office, when completed, will contain the largest vaults of their kind. They will be able, it is estimated, to hold $20,000,000,000 in gold. There is at present in the local Assay Office more than $900,000,000 in gold and more than $100,000,000 in silver. Five of the building's eight stories will be below the level of the street and three of them above.

Chronology of Mining, June, 1919

June 2—Period set for filing claims with War-Minerals Relief Commission closed, 1,287 claims having been filed.——U. S. Supreme Court decision handed down in Minerals Separation, Ltd., *vs.* Butte & Superior.——Pan-American Commercial Conference opened at Washington.

June 5—Powder explosion in Baltimore tunnel of Delaware & Hudson Coal Co. killed 83 and injured 50.

June 9—Arizona Employers' Liability Law held constitutional by U. S. Supreme Court in case against Arizona Copper Co.——American Zinc Institute opened first annual convention at St. Louis, Mo.

June 13—Strike of underground employees declared at mines in Grass Valley district, California.——War Trade Board announced scientific books and periodicals printed in Germany may be imported.

June 16—War Trade Board announced licenses will be issued for tin imports.

June 18—American Institute of Chemical Engineers opened semi-annual meeting in Boston.

June 19—Lake Superior Metal Mine Safety Conference opened in Duluth.

June 24—Strike at Park City, Utah, ended.

June 25—Bill introduced in both houses to create a Department of Public Works.

June 26—Interstate Commerce Commission permitted shippers to use old bills of lading until Sept. 8, 1919.

June 27—Arizona Chapter American Mining Congress opened bi-monthly meeting in San Francisco.

June 28—Strike of miners at Grass Valley, Cal., ended.——War Department offered platinum surplus for sale.

June 30—Transference announced of War Trade Board's personnel, powers, duties, and records to Department of State.

BY THE WAY

Junk

The connection between the secondary metals industry and criminal courts is not immediately apparent. However, according to an investigation made for the Juvenile Protective Association of Chicago, much of the delinquency of minors (not miners) in that city is to be attributed to the lure of the junk dealer. Statisticians will no doubt find it an interesting addition to the data already accumulated to estimate what portion of the secondary metals annually saved is "recovered" with the aid of the Fagins of the junk business. The householder who is blithesomely packing up for a month at the seaside should include the investigating committee's bulletin in his summer reading. When he returns he will then be prepared to answer the query, "Where are the lead pipes of yesteryear?"

Objection Sustained

"'Ere, partner, gos' 'long naow an' 'ave tha doctor take a geek at thee afor' thee gaws daown in the bal," said Cap'n Dick. "Better that thee's 'ol an' soun' than to 'ave some o' these 'ere physical difficulties 'amperin' thy work. These 'ere days, m'son, ut don't do. Back 'long we, in tha days o' 'ammer an' drill, Jan Penglase, 'e an' Dick Trevarrow wuz double-jackin' to Dolcoath mine. Many years befor' Jan 'ad los' 'is lef' h'eye, but few nawed abaout un, an' them as did figger'd as 'ow 'e 'ad a 'andsom glass one. Any'ow Dick never nawed till one day 'e wuz 'oldin drill an' Jan wuz strikin'. So 'appened w'en Jan lef' tha 'ouse in a 'urry that mornin' 'e came away leavin' this 'ere glass h'eye be'ind. They wuz takin' five, an' Dick looks h'up an' sees this 'ere h'empty socket. 'So 'elp me, Jan,' says Dick, 'W'ot's tha matter with tha h'eye?' 'Oh, dam-me,' says Jan, 'I lef' un 'ome; she's one o' these 'ere glass chaps. Never figger'd for to do that.' 'Well, gos' along with thee, Jan Trembath, I'm through,' said Dick; 'W'y, dam-me, man 'as 'ard nuff time strikin' with two h'eyes, let alone 'avin' one o' they glass beggars.' So thee can see, m'son, some men is powerful particular as to 'oo they works with an' these days a chap mus' be physically perfec'."

The Chromatic Rainbow Process

Tourists and perhaps metallurgists passing through Salt Lake City will find it worth while to visit the plant of the General Reduction & Chemical Co. there. The public has been invited, in fact, by the company to witness demonstrations in the new science of converting crude ore into finished paint. Its advertisement runs thus:

> The crude ore is crushed and by the application of various chemicals is reduced to pure pigments, such as prussian blue, white, chrome, red and arsenate of lead, and every desired shading or color. In fact, there are no colors we cannot produce. Besides this, we not only recover and set aside valuable byproducts, such as silver, zinc, iron and sulphur, or any other metal the ore may contain, but we save all chemicals, and use them over and over again.
>
> Mine owners are urged to bring in samples and have them treated free of charge.

"It seems unfortunate that a company producing paints like these did not advertise in colors," says George D. Van Arsdale. "Of course, it is a little difficult to understand from the advertisement where the colors are to come from, as it is stated that all metals are recovered as byproducts and all chemicals used over and over again. This is no doubt a mere matter of detail, and probably the pure pigments are only intermediate stages in the production of the final products.

"As a name for this interesting process there is so little choice between chromatic and rainbow that it would seem best to call it the chromatic rainbow process. With the suggestion of the pot of gold which we all know is at the foot of every rainbow, investment in the method should be much increased."

NEWS FROM WASHINGTON

By PAUL WOOTON
Special Correspondent

War Department Selling Platinum

The War Department is offering its present surplus of platinum for sale at a minimum of $105 per oz., and iridium at a minimum of $200 per oz., prices and orders subject to cancellation without notice. The sales will be made from the New York Assay Office and will be handled by the committee on sale of materials, New York District Ordnance Office, 1107 Broadway, New York. The minimum offer which will be considered by the committee will be for a quantity of 10 oz., and the maximum amount that will be disposed of to a single purchaser will be 1,000 oz., unless the Director of Sales deems it advisable to grant special permission for a sale of larger quantities.

The platinum will be delivered in the form of grains or sponge, and, as the New York Assay Office has limited facilities to prepare the product for delivery by either mail or express, the deliveries will be made wherever possible to the purchaser in person, cash being required in advance.

West Indian Surveys Division Formed

Arrangements have been made whereby the U. S. Geological Survey will direct certain extensive topographical surveys in several of the West Indian countries. It is probable that this will be followed by a similar arrangement for geological studies. The work will be done by members of the Survey staff, but the money for their salaries and for the other expenses incurred will be furnished by the governments for which the work is being performed. The arrangement offers to Survey staff members an opportunity for interesting and useful foreign service.

To handle this work the division of West Indian Surveys has been created, with Lieutenant Colonel Glenn S. Smith as the topographic engineer in charge. Though the members of the Survey's staff assigned to the West Indian division are technically furloughed without pay, they will continue to make their usual reports to the chief geographer and collect technical data for the use of the Survey.

Congress has appropriated $1,461,353.50 for the use of the Geological Survey during the present fiscal year. The total of the funds placed at the disposal of the Bureau of Mines is $1,201,897. Of the Survey's appropriation, $110,000 is to be used in gathering mineral statistics. This is an increase of 10 per cent over the amount available for the fiscal year just ended. The Bureau of Mines appropriation for investigating health conditions in mines and for a study of waste in mining is $125,000. The item in the bill which provides for three new mining experiment stations was eliminated, as was the section providing for Federal explosives regulations.

The Geological Survey will have $425,000 available for its topographic surveys. Of that amount $100,000 is to come from the War Department's appropriation, it is understood.

Engineering Training and Economics

After extensive discussion occupying two days, representatives of engineering schools and societies, at a meeting in Washington presided over by the Commissioner of Education, Dr. Glenn L. Swiggett, adopted resolutions recommending that economic phases of engineering subjects should be emphasized, wherever possible, in engineering instruction. This may be done, it was stated, by emphasizing the problems of values and costs in the regular technical work and by introducing or extending courses in general economics, cost accounting, business organization, and business law into the engineering curricula. These courses should be designed particularly to meet the needs of the engineering student.

It was also recommended that the engineering phases of economic subjects should be emphasized wherever possible in commercial instruction, and all institutions with departments in engineering and economics or commerce were urged to consider some plan to develop a course in preparation for careers wherein practical training in modern languages, in the essentials of engineering and business theory and practice have been found helpful and necessary.

Tin Import Ruling Changed

The War Trade Board section of the Department of State will issue licenses permitting the importation, on or after Sept. 1, 1919, of pig tin and all metal alloys containing tin, including oxides, from points other than points of origin and without reference to the date of shipment.

On June 30 the transference was announced of the War Trade Board's personnel, duties, powers, and records to the Department of State, as of July 1.

A Becker Fellowship

An effort is being made to establish a fellowship in memory of Dr. G. F. Becker. Edward B. Mathews, chairman of the division of geology and geography of the National Research Council, has been active in promoting the movement. It is expected that John Hays Hammond will serve as chairman of a committee which will "confer with others similarly interested and report specific recommendations."

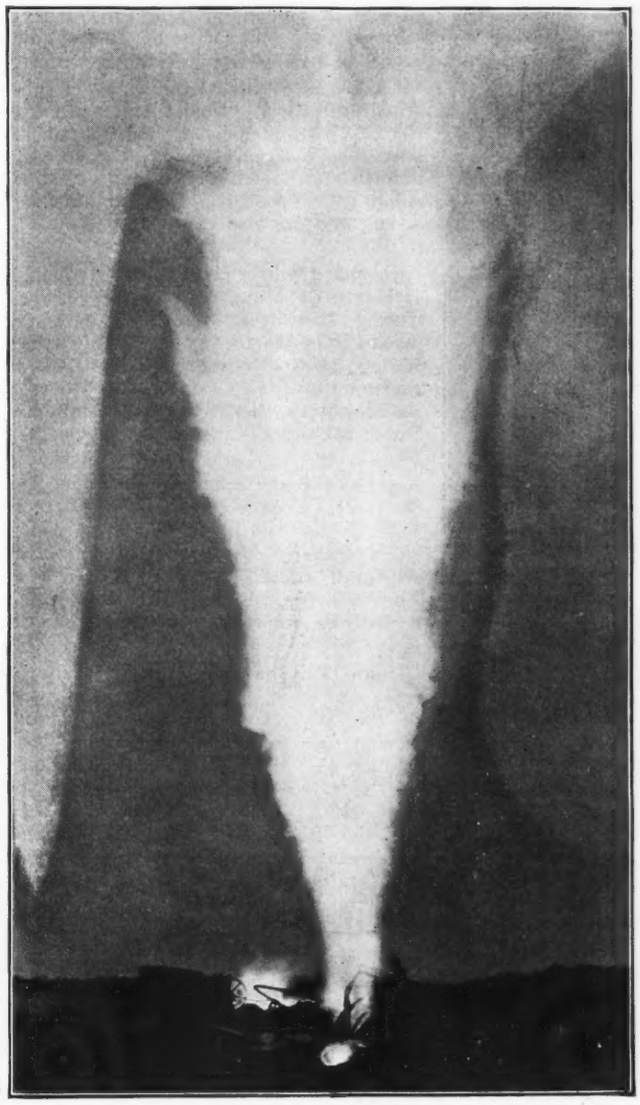
Czecho-Slovak Mission Here

A Czecho-Slovak technical mission is in the United States to study development of mineral resources and water-power. The commission also will make studies of flood control and irrigation. The membership of the commission is as follows: Joseph Spaek, member of No. 1 Assembly; Stanislav Spaek, of Ministry of Public Works; Charles Anger, of Ministry of Public Works; Vaclav Masek, of Ministry of Agriculture; Frank Binovec, member of No. 1 Assembly; and Lieutenant Frank Mick, of the Ministry of Foreign Relations.

Extinguishing a Burning Gas Well

CALIFORNIA CORRESPONDENCE

On the evening of June 2, 1919, well No. 4 of the Standard Oil Co. of California, in Elk Hills, Sec. 36, T. 30 S., R. 23 W., M. D. B. & M., came in as a heavy gusher, and caught fire. The 10-in. casing had been cemented at 2,520 ft., and the well was being bailed to test the water shut-off. Gas broke in, shooting the bailer up into the derrick. The drillers were able to close the head valve and reach a point of safety. The pressure became so great that the valve was torn from the casing. Undoubtedly the friction of tearing the



VIEW OF A BURNING GAS WELL

casing caused the gas to ignite. No one was injured. The capacity of the well was estimated at 30,000,000 cu.ft. per day.

The company decided to smother the well with steam. The accompanying photograph indicates that considerable junk, such as rotary drilling outfit, drill stem, crown blocks, and piping, was close to the well. Naturally, all this metal was red hot and, unless removed before smothering the well, would ignite the gas again. A fire screen of corrugated iron, about 8 ft. high and 25 ft. long, was constructed and carried to the edge of the junk pile by several men. Other men followed with streams of water, playing it on the screen, on the ground, and on the men. The men were equipped with heavy woolen clothing and asbestos shoes. A drag cable was carried up behind the screen, and, working in short periods, the men were able to remove all the hot metal.

While this was going on, a battery of five boilers had been set up, about two hundred yards away from the well. These boilers, together with ten drilling boilers at other wells, supplied the steam. From different directions, three steam lines were laid as near to the well as possible without protection. Sections of pipe were made up long enough to reach the remaining distance to the well. Under the protection of the fire screen, these sections were carried to the collar of the well, and connection was made to the lines leading from the boilers. Steam was turned into these lines simultaneously. The first two attempts to smother the well were failures, because of insufficient steam. After slight changes were made in the method of applying the steam, the third attempt was successful.

The following day the ground had cooled sufficiently to permit an examination of the casing, which was found to be intact at the bottom of the first joint. A control valve has been put on the well. The gas flowed freely through a 4-in. opening under a pressure of 210 lb. per sq.in. The accompanying photograph shows the burning well before the attempt was made to extinguish it.

Explosives in Trans-Mississippi States in 1918

A total of 9,866,534 kegs of black blasting powder, 206,516,077 lb. high explosives, and 46,045,233 lb. permissible explosives was manufactured in the United States in 1918, and the following quantities were used in states west of the Mississippi, according to a recent bulletin of the U. S. Bureau of Mines:

	Black Blasting Powder, Kegs	High Explosives Other Than Permissible, Pounds	Permissible Explosives, Pounds
Alaska	178	2,213,600	41,200
Arizona	8,833	13,124,525	15,600
Arkansas	105,768	826,461	103,400
California	43,538	8,517,684	1,600
Colorado	92,975	4,902,915	905,550
Idaho	5,857	2,874,630	4,550
Michigan	20,907	24,994,152	23,600
Minnesota	179,045	9,941,860	.....
Missouri	219,571	9,120,244	168,904
Montana	112,033	8,216,874	51,100
Nevada	11,507	4,733,025	505
New Mexico	7,913	2,576,310	775,250
Oklahoma	196,083	8,955,527	1,102,770
Oregon	22,902	2,816,684	1,150
Texas	44,380	1,206,020	28,200
Utah	27,211	3,610,556	4,430,820
Washington	49,647	5,934,194	427,800
Wyoming	128,178	416,850	590,500

New Outrage in Mexico Probed by State Department

The State Department at Washington has inquired of the Carranza government concerning the measures it is taking to protect foreigners from the attacks of bandits as well as of soldiers of the existing regime. This action has been hastened by recent reports that an American citizen, John W. Correll, was murdered on June 16 at Colonia, twenty-seven miles north of Tampico, while attempting to protect his wife. Complaints of other outrages have also been received since repeated assurances were given by various officials of the present Mexican government that the lives and property of foreigners would be safeguarded in Mexico.

PERSONALS

E. E. Carpenter, recently in San Francisco, will return soon to Tonopah.

Harry J. Wolf recently made an examination of mining property near Salisbury, North Carolina.

Robert E. Tally, assistant manager, United Verde Copper Co., is spending a short vacation in California.

A. C. Bedford has returned from France and England, where he went in the interests of the Y. M. C. A.

Theodore J. Hoover has been appointed to take charge of the mining department of Stanford University.

Henry Oliver, president of the Oliver Iron & Steel Co., will be a director of the recently incorporated Simms Petroleum Co.

A. G. McGregor, of the firm of Rippath & McGregor, is making plans for the erection of a $25,000 residence in Warren, Ariz.

Kirby Thomas has returned to New York from Colorado, where he has been engaged in making examinations in the San Juan district.

J. Volney Lewis will spend several weeks on professional work in the Las Animas district of New Mexico. His address will be Hillsboro.

H. E. Minor, formerly geologist for the Gulf Production Co., is now on the staff of the Sinclair Gulf Oil Co., with headquarters in Houston.

J. E. Curry, secretary, Arizona Chapter, American Mining Congress, of Bisbee, is spending a month on the California coast with his family.

Hoval A. Smith has returned from a ten-day trip into the Moctezuma mining district of Sonora, Mexico, where he is interested in silver properties.

Sidney L. Shonts, mining engineer of Wallace, Idaho, is engaged in investigating claims of chrome producers in eastern Oregon for the Government.

Lorin Kemp is spending several months in the United States, after which he will return to South America. He is on the staff of the Chile Exploration Co.

Scott Turner has recently been appointed consulting engineer to the Mining Corporation of Canada, Ltd., 1511-20 Bank of Hamilton building, Toronto, Ontario.

E. W. Wagy, petroleum engineer of the Bureau of Mines, stationed in San Francisco, is in Illinois studying production methods in use by oil operators in that district.

George T. Smith, president of the Joseph Dixon Crucible Co., together with the directors, lately made the annual inspection of the properties of the American Graphite Co.

Captain J. C. Ray, a California mining engineer, late of the 544th U. S. Engineers, has been appointed manager of the Bellevue Mining Co.'s properties in the Rice Lake district, Manitoba.

H. Kenyon Burch, consulting engineer, Phelps Dodge Corporation, has returned to his headquarters in Bisbee, Ariz., after a visit of inspection to the company's plant at Nacozari, Sonora.

C. E. Julihn, superintendent of the Lake Superior station of the U. S. Bureau of Mines, and his assistant, **G. E. Ingersoll**, are on the Mesabi Range, working in the interests of the Bureau.

D. E. A. Charlton, Managing Editor of the *Journal*, has returned to New York after a month's trip through the Minnesota and Michigan iron and copper districts.

George J. Young, Assistant Editor-in-Chief of the *Journal* since January, 1918, has left for San Francisco, to assume the position of Western Editor of the *Journal*, with headquarters at the Rialto Building.

GEORGE J. YOUNG

Fred Crabtree, consulting metallurgist with the Bureau of Mines, is in charge of the recently organized cooperative department of mining engineering of the Carnegie Institute of Technology.

B. C. Yates, superintendent of the Homestake Co., at Lead, S. D., is spending his vacation visiting points of interest in Colorado. He is accompanied by his family, and is making the trip by automobile.

Captain E. R. Graham has returned from service in France and has taken up his residence in Lead, S. D. Previous to his entering the army Mr. Graham was superintendent of the Mogul Mining Co.

W. Fleet Robertson, provincial mineralogist of British Columbia, has been appointed acting deputy minister of mines of that province, during the absence of **R. T. Tolmie**, who has been granted sick leave.

Richard Bollas, of the engineering staff, Copper Queen mine, Bisbee, has resigned, to take over the management of the Smith-Cananea Mining Co., whose property is situated in Cananea, Sonora. It will be worked for silver.

J. Wallace Bostick is now chief geologist of the National Oil Co., of Philadelphia, and has recently made two locations for this company in Duval County, southwest Texas. Mr. Bostick was assistant geologist in the oil division of the Southern Pacific Ry.

J. A. O. Preus, State Auditor, and **F. A. Wildes**, State Mine Inspector, of Minnesota, have returned from Cleveland, Ohio, where they were in conference with officials of the Fort Henry Mining Co., operators of the Woodbridge mine, situated at Buhl, Minn.

Charles T. Willis, head of the industrial relations department, Phelps Dodge Corporation, has returned to his home in Warren, Ariz., after an extended visit to the company's copper camps at Tyrone, N. M., and Morenci, Ariz., and its coal camp at Dawson, N. M.

Joseph Hyde Pratt, State Geologist of North Carolina, has secured his discharge from the Army and has returned to his former duties. As Colonel of the 105th Engineers, a combatant regiment which served for eleven months with the British in Flanders, Dr. Pratt did distinguished service.

John W. Mercer, who has been the American Red Cross commissioner for Switzerland, expects to return to New York by the end of the summer, as his work is then expected to be completed. All mail should be sent to his New York address, 15 Broad St., from which it will be forwarded if there is still time.

John F. Shaforth, former Senator from Colorado, presided at the session of the War-Minerals Relief Commission at the University of Arizona, June 21 and 23. **H. E. Meyer**, of Washington, secretary, former president of the A. I. M. E., and **Paul S. Black**, council for the Bureau of Mines, were also present. The commission heard the war claims of a number of southern Arizona mining men.

OBITUARY

Elwyn Waller, for many years professor of analytical chemistry at the Columbia School of Mines, died at Morristown, N. J., recently. He was seventy-three years old, and was graduated from Harvard, becoming assistant instructor at Columbia in 1871 and professor in 1885, continuing there until 1893. Professor Waller was mineralogist at the Santo Domingo Exposition in 1871. He was a member of many engineering societies.

Charles K. Lipman, who since 1905 had been prominently identified with the Guggenheim interests, died on July 2 at his home, No. 205 West 89th St.,

New York. He was vice-president of the following concerns: Chile Copper Co., Braden Copper Co., Yukon Gold Co., and the Yukon-Alaska Trust Co., and was a director in many allied and subsidiary concerns. Mr. Lipman was born in California fifty-two years ago, and all of his business career had been in mining projects. He came to this city thirteen years ago. Mr. Lipman leaves his wife and one brother, Frederick L. Lipman, who is vice-president of the Wells Fargo-Denver Bank, of San Francisco.

SOCIETIES

The Chemical Foundation, Inc., has published a 60 p. report describing its aims and purposes and the reasons for its organization, as told by A. Mitchell Palmer, U. S. Attorney General and former Alien Property Custodian in his report to Congress, and by Francis P. Garvan, Alien Property Custodian, in a recent public address.

American Society for Testing Materials had the opening session of the 22d annual meeting on June 25 at Atlantic City, N. J. The election of the following officers has been announced: President, J. A. Capp; vice-president, C. B. Young; executive committee, Ernest Ashton, H. F. Moore, C. R. W. Ryes, and Admiral D. W. Taylor, U. S. N. The membership now is 2,500. Revisions have been proposed in four tentative standards, including those for openhearth steel girders, high T-rails, and engine-bolt iron. Five tentative standards, including that for malleable castings, have been recommended for adoption. Recommendations for the use of the Saybolt viscosimeter were adopted. The committee on preservative coatings reported results of tests had not been sufficiently conclusive to warrant recommending any particular method of preparing iron and steel for painting.

INDUSTRIAL NEWS

Gauld Supply Co., Incorporated, has taken over the business of the Gauld Co., Portland, Ore. The directors of the new company are William P. F. Ayer, president; Thomas Nickerson, vice-president; G. A. Ricker, treasurer; Theodore W. Little and Carl T. Keller, all of whom are prominently connected with the Walworth Manufacturing Co.

Eastern Foundry & Machine Co., Inc., announces the placing in operation of its new plant at Ambler, Pa. This company furnishes bronze castings, bushings, cord bars, bearings, or specification work. General sales offices, 706 Liberty Building, Philadelphia. B. J. Morrison, general sales manager. R. W. Dale, assistant general sales manager.

Electric Hoist Manufacturers' Association held the regular monthly meeting on June 27 at 9 East 40th St., New York. A pamphlet prepared by the engineering committee is available by applying to the secretary, W. C. Briggs, 30 Church St., New York. A new pamphlet on track, supports, current conductors, and other subjects will be issued soon.

War Department, office of ordnance district chief, Equitable Building, St. Louis, Mo., offers for sale a quantity of black iron pipe, second hand, random lengths. Also quantities of new galvanized iron pipe and fittings and caulking lead. Complete description and conditions of sale are furnished by the St. Louis Salvage Board, Committee on Sale of Materials, Lieutenant Cleve A. McMullen, Ordnance Department, U. S. A., secretary.

Hamilton & Hansell, Inc., New York City, announces the selling of the following electric furnaces: One 1,000-lb. Rennerfelt furnace, 400 k.v.a., to the Steel Alloys Co. of America, to be erected at its plant in Bayway, Elizabeth, for the reduction of tungstic acid to metallic tungsten. One 1,000-lb. Rennerfelt furnace, 200 k.v.a., to the British-American Nickel Co., Ottawa, Canada, to be erected at its Deschene plant in Quebec, for melting nickel.

Federal Trade Commission formally charges the Non-Derrick Drilling Machine Co., Inc., Pittsburgh, ostensibly organized for the manufacture of an apparatus for the drilling of oil, gas, and water wells, with false and misleading advertising and misrepresentations to the public in the interstate sale of stock. The company was incorporated in June, 1917, the complaint sets forth, and has not yet engaged in actual manaufacture. The concern is cited to make answer before the commission in Washington on Aug. 11.

TRADE CATALOGS

Fume Recovery, Dust Collecting, Pneumatic Conveying. The Dust Recovering and Conveying Co., Cleveland, Ohio. Illustrated pamphlet describing the operation of handling gases from driers and arsenic dust with Perfecto filters, automatic cutouts, and condensers.

"Bulldog" Jaw Crushers. Traylor Engineering & Manufacturing Co. Bulletin JX-1; 6½ x 9½; 26 pp.; illustrated. Descriptive of the Traylor "Bulldog" jaw crusher, designed to have a stronger and more reliable main frame than could be made with either cast steel or cast semi-steel, because of the difficulties in making a perfect steel casting of the complicated sections necessary and having them properly annealed. Other parts, viz., pittman, toggles, and oiling system, are included.

Lilly Gravity Electric Hoist Controller. Duro Metal Products Company, 361 East Ohio St., Chicago. Catalog B1, 7½ x 10½; 8 pp., illustrated. Descriptive of the Lilly controller, the principles of which are based on the laws of gravitation and electricity and designed to control and regulate the operation of steam, air, and electric hoists. It is claimed to possess instantaneous action, positive results, to sound an alarm when excess speed is attempted, and will stop the hoist if the engineer fails to respond. The operation is briefly: The force of gravity is prevented from actuating the controller by an electro-magnet acting through a series of levers so that only a small current is necessary to hold it in balance. When an emergency arises, and current is broken by the controller, the levers are instantly taken from the engineer. It is stated the closed-circuit system insures against possibility of failure by a broken or loose wire.

NEW PATENTS

U. S. patent specifications may be obtained from the *Engineering and Mining Journal* at 25c each.

Fuel—Fluid-Pressure Apparatus for Burning Powdered Fuel. Patrick A. Leonard, Michael F. Maloney, and Ernest Fandrich, Schenectady, N. Y. (U. S. No. 1,305,726; June 3, 1919.)

Gasoline—Recovery of Gasoline from Natural Gas, etc. Edmund S. Merriam, Marietta, Ohio. (U. S. No. 1,304,587; May 27, 1919.)

Lead—Extraction of Lead (Electric Smelting). Edward Salomon Berglund, Trollhättan, Sweden, assignor to Sven Huldt, Stockholm, Sweden. (U. S. No. 1,306,942; June 17, 1919.)

Lead—Process for the Electrolytic Deposition of Lead. Dell F. Harbaugh, Chicago, Ill. (U. S. No. 1,306,479; June 10, 1919.)

Magnesite — Manufacture of Bricks and Furnace Linings from Dead-Burned Magnesite. Samuel Gerard McAnally, Hull, Quebec, Canada. (U. S. No. 1,305,475; June 3, 1919.)

Molybdenum—Extraction of Molybdenum. Tormod Reinert Förland, Haugesund, Norway. (U. S. No. 1,305,350; June 3, 1919.)

Pyrolusite—Method of Treating Pyrolusite. Carl Valdemar Jorgensen, Copenhagen, Denmark. (U. S. No. 1,303,911; May 20, 1919.)

Separator—Hydraulic Separator for Crushed Ores. Henry R. Wahl, Chicago, Ill. (U. S. No. 1,306,361; June 10, 1919.)

Separator—Magnetic Ore Separator. Lewis G. Rowand, Brooklyn, N. Y., assignor to the New Jersey Zinc Co., New York, N. Y. (U. S. Nos. 1,303,396; 1,303,397, and 1,303,398; May 13, 1919.)

Separator—Ore-Separating Machine. Joseph William Miller, Miami, Okla. (U. S. No. 1,306,270; June 10, 1919.)

Sintering—Treating Fine Ores. Daniel Shields McAfee, New York, N. Y., assignor to the Dorr Co. (U. S. No. 1,305,817; June 3, 1919.)

EDITORIAL CORRESPONDENCE

Current Events and Topics in Brief of Interest to Engineers and Operators

SAN FRANCISCO, CAL.—July 3

New Oil Wells started during the first half of the year 1919 totaled 307, as compared with 406 and 577 for the same period in 1918 and 1917. The number for last week was 16, which is considerably above the average so far. Nine were in Kern County, three in Ventura and three in Los Angeles neighborhood. There were 18 wells ready for test of shutoff, 20 being deepened or redrilled, and four abandoned. A notable development during the week was the striking of oil in the Myers well of the Union Oil Co., about four miles east of the Coyote Hills field, and three miles south of the Whittier field.

The Government Oil Land Suit against L. B. McMurtry, charged with illegal and fraudulent entry of 160 acres in Kern County, has been decided in favor of the defendant by Judge Robert S. Bean, of Portland, Ore., sitting in the U. S. District Court at Los Angeles. McMurtry located the land in 1909 and secured eight individuals and companies to file mineral claims on it. The locators, after filing, let a contract for development. The contract was transferred by J. M. McLeod, the contractor, to his attorney, who re-transferred it to McMurtry. The Government charged that McMurtry sold portions of the land for large sums and contended that the land and the proceeds of the sales were secured by fraud. The court held that in making the location and subsequent contracts in relation thereto, the fair consensus of opinion from the evidence was that McMurtry was acting for and in behalf of his principals, with no intention at that time of fraudulently acquiring the land or proceeds therefrom for himself.

GRASS VALLEY, CAL.—July 3

Marysville Nevada Water Co. has selected a site a mile and a half below Bullard's Bar, on the north fork of the Yuba River, and twenty miles west of Grass Valley, for its proposed restraining dam. This is intended for hydraulic tailings to come from renewed operations at a number of old camps in Sierra and Nevada counties. A nominal charge for storage will be made. The overflow is to be used for power generation.

The Strike at Grass Valley, after continuing for fifteen days, ended suddenly on the evening of June 28, when the Mine Workers' Protective League voted almost unanimously to accept the operators' revised proposal. The new wage scale calls for a 10 per cent advance over the old rate, wherever employed, with the provision that the extra amount will be paid in a lump sum to each man on the payroll at the end of a certain length of time. Provisions are also made for the men to leave the employ of the company, when necessary, without loss of pay, and half pay will be allowed for time lost during the strike. All mines resumed work on June 30, the Empire and North Star mines operating with greatly reduced forces. The lower levels of these mines have flooded, but the men were put to work higher up. The Pennsylvania drains into the Empire. Milling cannot be resumed for some time. The Western Federation of Miners had no voice in the strike, although it has a chapter at Grass Valley. No violence was reported. About 1,000 men are enrolled in the Mine Workers' Protective League.

SALEM, ORE.—July 3

A Board to License Oregon Engineers has been appointed by Governor Olcott of Oregon, in conformity with the act passed by the last Legislature requiring the licensing of all professional engineers. Under the new law all engineers will be required to register. The board consists of two civil engineers, two mechanical engineers, two hydraulic engineers, and one electrical engineer.

WALLACE, IDAHO—July 3

The Question of a Strike in the mines of the Coeur d'Alene district has been deferred until after July 25. This was decided at meetings of the local branches of the International Union of Mine, Mill and Smelter Workers, when the question was submitted to a vote of the membership. Union leaders state that the request of the conciliation commissioner, Robert M. McWade, to postpone the strike, is all that prevented it carrying by a large mapority.

Consolidated Interstate-Callahan Mining Co. is preparing to resume operations early in August, after a suspension of about four months. A few weeks ago the management stated that when zinc reached 7c. per lb. the company could earn a fair profit, even with the prevailing high cost of mining, and that if the market seemed stabilized around that figure the company would feel justified in resuming production on a normal basis. Though the chief product of the mine is zinc, the company also produces considerable lead. The mill recovery of lead has never been satisfactory, and for months before the shutdown the manager, C. W. Newton, had been conducting experiments with the view to reducing the lead losses in flotation. As a result, in the last month of operation the lead produced was almost double what it had been formerly, the character of the ore being the same. When the mine closed down plans were at once prepared to add a lead flotation section to the mill which is nearing completion and is expected to double the company's lead production. New classifiers and a ball mill are also being added to the mill equipment. Another change is being made in handling crude ore. Heretofore, the ore coming from the mine was conveyed direct to the mill by tramway, where it passes over sorting belts to permit removal of waste rock and shipping ore. A sorting plant is now being built at the mine, where the waste will be removed before the ore reaches the tramway, and another sorting plant is being provided at the mill, where the first-class ore will be removed for shipment crude.

BISBEE, ARIZ.—July 3

Hoval A. Smith, well known as a mining engineer in the Southwest, recently returned from a ten-day trip into the Moctezuma mining district of Sonora, Mexico. Mr. Smith stated that confidence was in evidence all over northern Mexico and that although there were many problems to be worked out, and some time will be needed to bring things back to normal so far as the mining industry is concerned, conditions there today are not as serious as some believe. The resources of Sonora are great, Mr. Smith said, and the transportation problems are not, as a general thing, serious handicaps, and, with silver at $1.07, there is no question that the country will be developed rapidly in the near future. Mr. Smith was formerly chief engineer for the Calumet & Arizona Mining Co., and was one of the promoters of the Warren company and Warren ranch at Bisbee, as well as the Globe Consolidated Mining Co., of Globe.

SALT LAKE CITY, UTAH—July 3

Working Forces at Park City Mines are being increased gradually to normal. Practically all mines are operating. Work has not yet been resumed at the Judge electrolytic zinc plant, owing to an accumulation of spelter. Before the close-down the company was producing a high grade of spelter, and the problems of operation had been satisfactorily solved. It is expected that the plant will resume operations in a few weeks, when it is probable there will be a greater demand for spelter.

Changes in the Workmen's Compensation Law, made at the last session of the Utah Legislature, whereby, among other things, the rate of compensation has been increased, became effective July 1 and are given as the cause of increased insurance rates charged by stock companies operating in the state. A lower rate is charged by the state insurance fund, but this in some quarters is considered inadequate. To meet state competition the companies will adopt merit-rating and experience-rating plans intended to give an employer credit for installing safety devices and otherwise providing working conditions that will reduce the liability to accident to a minimum. Experience rating will apply only to companies having an annual premium of $500 or more. A company with a good showing as to accidents for twenty-one months just ended will be given allowance in the next year's premiums. It is said the merit and experience ratings may bring premiums in individual cases down to almost the same as, or possibly a lower rate than, that charged by the state fund. The advance made was fixed in New York at a meeting of companies affiliated with the National Workmen's Compensation Bureau, and all companies operating in Utah except one will be bound by the rate fixed. The new rate is 26.5 per cent on $100 in excess of the old rate. Compensation is now at the rate of 60 per cent of the average weekly wage, instead of 55 per cent, as formerly; and the maximum weekly payment in most instances is $16 instead of $12. The minimum in all cases is $7 per week. The maximum aggregate payment in all is $5,000, except in case of total disability. For total disability the compensation is 60 per cent for 45 weeks, and 45 per cent until death, with a maximum of $16 per week and a minimum of $7 per week. Additional compensation up to a maximum of $500 is allowed for hospital and nursing expense, and up to $150 for funeral expense.

DENVER, COL.—July 4

The Industrial Commission of Colorado announces that advances in rates necessitated by amendments to the law adopted by the last Legislature will not effect mining insurance now in force under the State Fund, or insurance renewable in July, and that renewals to Dec. 31, as well as new insurance, will be written in the fund at the present rate, until July 31, after which the rate will probably be advanced 15 per cent. The new law provides for an increase in the weekly benefit from $8 to $10, cuts down the waiting period from fourteen to ten days, increases the death payment from $2,500 to $3,200, and provides $200 for hospital fees, instead of $100. The State Fund will declare a dividend on mining risks of 15 per cent of premiums paid for the first half of 1919.

In Molybdenum Production Colorado ranks first, according to the fifteenth biennial report of the State Bureau of Mines, covering 1917 and 1918, which was compiled by Fred Carroll, until recently the State Commissioner of Mines. The equivalent of 665 tons of concentrates averaging 90 per cent molybdenum sulphide, valued at $1,436,400, is the estimated production of the state for 1918. The world production in 1915 was slightly under 250 tons. Colorado's output is derived from the properties of the Climax Molybdenum Co., at Climax, in Summit County, and of the Primos Chemical Co. at Camp Urad, in Clear Creek County. It is estimated that molybdenum can be produced at these mines for 50c. per lb., states the report. Construction was started on these properties in 1917 and milling by flotation in 1918. The mines of the state also produced in 1918 a total of 7,071,768 fine ounces of silver (7,304,353 in 1917); 6,423,919 lb. of copper (8,122,004 lb. in 1917); 64,282,841 lb. of lead (67,990,012 lb. in 1917); and 88,641,748 lb. of zinc (120,315,75 lb. in 1917). At present, according to the report, there are five smelteries operating in Colorado, with a daily furnace capacity of 4,000 tons, of which not more than 60 per cent is utilized, although a large tonnage of ore is imported from other states.

GLENROCK, WYO.—July 3

The Midwest Refining Co., at Casper, Wyo., has expended over $2,000,000 in the last year in new construction and additions to its refinery, and now has a daily refinery capacity of 55,000 bbl. The company has started work on erection of a refinery at Laramie, Wyo. The Riverton Wyoming refinery, at Riverton, has started operations, and most of the oil will be taken from the Dallas field. In the Lance field, the Buck Creek company brought in well No. 4. The oil sand was tapped at 3,650 ft. In

the same field the Lusk Royalty company has five wells drilling, but as yet these have not gained sufficient depth to prove the presence of oil. The Ohio company is drilling for the Lance Creek Royalty and has reached a depth of 3,600 ft. Oil was encountered at 2,700 ft., but it was decided to go deeper for a larger production. At present 230 wells are being drilled in the different oil fields of Wyoming. The 1919 session of the Wyoming State Legislature passed the Carbon Black bill, which prohibits the manufacture of carbon black from natural gas in Wyoming within ten miles of an incorporated city. The measure takes effect Oct. 1, 1919, and is protested by producers of this material.

EDGEMONT, S. D.—July 3

In the Mule Creek Oil Field, west of Edgemont, in Wyoming, the Ohio Oil Co. has brought in its second well. Though it has a capacity of only 100 bbl., it is encouraging, in that it marks the boundary of this oil area and greatly extends the productive area. This new well is four miles from the pioneer well on the Norbeck and Nicholson lease and opens a large track for oil drilling. North of the Mule Creek area, Norbeck and Nicholson are drilling on a structure known as the Cottonwood Dome.

HOUSTON, TEX.—July 2

Invincible Oil Corporation, of New York, incorporated under the laws of Virginia, with capitalization of $14,000,000, has acquired contract from Invincible Oil Co. for all its holdings. Consideration involved is said to be $5,000,000. Through a merger with the Gladstone Oil & Refining Co., of Oklahoma, and the Louisiana Oil & Refining Co., of Shrevesport, the Invincible corporation has acquired 83,643 acres of land, held by fee and leases, in the Ranger and Blue Ridge fields in Texas, and in the Walters and Cement fields in Oklahoma, with estimated production now of 3,500 bl. to 5,000 bbl. daily. Other holdings are in Stephens County, in the Humble field, and in Alabama. The corporation has one refinery of 300 bbl. capacity in operation, together with 70 miles of gathering lines, and 200,000 bbl. storage capacity; also 160 steel tank cars for transportation to tidewater export station, at New Orleans, where storage capacity of 100,000 bbl. is provided. Second refinery of 3,000 bbl. capacity nearing completion at Fort Worth.

MOUNTAIN HOME, ARK.—July 3

Mining Operations in the north Arkansas zinc and lead field are nearly at a standstill. Less work is being done than at any time during the last five years, and at the same time there is more ore developed. Most of this is zinc carbonate averaging 40 per cent zinc, which is bringing from $22 to $28 on the present market, which, the operators say, will not pay. A limited amount of development and prospecting is in progress.

DULUTH, MINN.—July 3

The Minnesota State Supreme Court has upheld the finding of the district court at Brainerd, whereby Patrick Hammel established his right to one-half interest in mining lands held by the estate of the late Thomas Feigh. The lands involved include two operating properties on the Cuyuna Range, the Hillcrest and the Feigh, and the Hammel share of royalties at the time suit was begun amounted to $135,700, to which must now be added the 1917 and 1918 earnings of the properties. It was held by Hammel that under an arrangement between himself and Feigh he was to do the detail work of locating the properties while Feigh furnished the money, and that the properties were placed in Feigh's name to protect his investment. The agreement was that all profits should be divided half and half. A sidelight of the trial has developed in a new trial in which H. B. Blackwood, of Duluth, who controlled the lands involved at the time Hammel and Feigh were negotiating for them, now claims one-half of Hammel's interest under an agreement he claims to have had with Hammel.

HOUGHTON, MICH.—July 5

Calumet & Hecla's loss by fire of the Hancock & Pewabic engine house, with the hoisting plants contained, did not interfere with production. The plant served four shafts on the conglomerate, namely Nos. 7, 8, 9 and 10, the last two being a double shaft, all in the South Hecla branch of the main Calumet & Hecla mine. Within twelve hours after the fire, one of the shafts was connected with an auxiliary hoist, and within twenty-four hours all shafts were producing rock and hoisting at normal rate. These four shafts, which are included in the program for greater development with depth that is planned for the Calumet & Hecla conglomerate lode, are among the deep mining shafts of the Lake Superior district. No. 7 is below the 81st level. No. 8 was permanently discontinued at the 63d level, and Nos. 9 and 10 were 142 ft. below the 82d level, a depth of 8,132.7 ft., on Jan. 1.

Because of the excessive cost of maintaining Nos. 6 and 7 Hecla and Nos. 9 and 10 South Hecla, it was determined some months ago to discontinue sinking at these points. To reach the ground lower down in this end of the mine a haulage level (at the elevation of the 80th level) connecting this territory with the Red Jacket shaft, is being driven in the amygdaloid lode 180 ft. under the conglomerate. This haulage level, when completed, will be 7,800 ft. long, 3,700 ft. having been driven already. Shafts will be sunk from the haulage level, from which the conglomerate will be mined. Power tramming will be used to get this product over to the Red Jacket shaft, where it will be sent to surface.

SNOW TUNNEL BETWEEN SANDON AND CODY, B. C., ON ROAD TO NOBLE FIVE MINE DURING LAST SEASON

BIRMINGHAM, ALA.—July 5

At the Woodward Iron Co.'s Plants there is considerable construction and repair work in progress, notably at the company's No. 1 mine, on Red Mountain. The company has two furnaces in operation out of three at Woodward, Ala.; the third now being repaired. It is expected this furnace will be blown in soon. Sinking has begun at the company's Songo mines. Electrically operated elevators and other time-saving devices are to be used here to eliminate expensive haulage.

All classes of industry in the district seem to have speeded up. Coke production is being increased to meet orders now being received. With iron up $1 per ton, and production increasing, several large companies are out of the market at present prices for third-quarter delivery. Cast-iron pipe shops, machine shops, and foundries with plenty of orders on hand or expected are gradually working back to normal operating schedule. The Republic Iron & Steel Co., the Sloss-Sheffield Steel & Iron Co., and the Alabama Co. are expected to blow in a furnace in the next few weeks. On the whole, July opened with the brightest promise of a good month in production and sales in the iron and steel industry this district has experienced for some time.

No statement as yet has been received from the various companies as to their attitude toward the movement to unionize the steel and iron workers in the district. The organizers are credited with the statement that no strike is in prospect, but only the right to organize and do collective bargaining with employers is sought.

Suit has been brought by Wiley Nunn against the Woodward Iron Co., for $3,000 for injuries to a minor son formerly employed in the company's mines. Suit has been brought by Will Gray against the Tennessee Coal, Iron & R.R. Co. to collect $3,000 damages, for injuries received in the company s employ.

BOSTON, MASS.—July 7

Shannon Copper Co. states officially that an agreement has been entered into with the Arizona Copper Co., Ltd., of Clifton, Ariz., to sell the latter the Clifton and Metcalf, Ariz., properties of the Shannon company for approximately $600,000. It is possible that operations at Gleason and Yeager may be resumed, but the directors have not definitely decided upon any policy for the future.

VICTORIA, B. C.—July 3

The Free Miners' League has recently been formed at Prince Rupert, B. C. It has announced its purpose to be "the employment of a permanent secretary in premises containing collections of local ores," together with information about them and other mining literature. It has petitioned the provincial government to establish an assay office at Prince Rupert, one-half the cost of assays made to be paid by the individual and the other half by the government. Weston Coyney, Prince Rupert, is secretary. Membership in the Free League costs $5 a year.

The Noble Five Mine, situated between Sandon and Cody, in the Slocan mining division, British Columbia, is installing a 100-ton concentrator that, it is expected, will be ready for operation this autumn. The company now has a considerable force engaged on development work. The photograph on this page was taken early this year by Paul Lincoln, manager of the Noble Five, on the Old Cody Road running between Sandon and Cody. When the snowslide shown took place, some of the company's employees were busy repairing the road. They had little notice of their danger, and two of them lost their lives. The slide was one of the greatest in the history of the district, and, as the view indicates, it was necessary to tunnel to open to the mine last spring.

The Committee Investigating Smelting Rates charged by the Consolidated Mining and Smelting Co. for treating custom ores at Trail has gone at length into the information it secured in a report of twenty-two pages. Its conclusions have been summarized as follows: "A new smelting rates schedule which, applied to average ores received at Trail smeltery during the seven months ending April 30 last, is being prepared. It will effect an average saving to shippers of $3 per ton. Most of this benefit will accrue to producers of silver-lead-zinc ores, who were hit hardest by Schedule B. Miners of oxidized ores, or low-silver, low-zinc ores will benefit very slightly, if at all, by the new rates.

"Prior to the introduction of Schedule B and for some time afterward, the lead-smelting operations of the company were conducted at a loss. Though other causes of this loss existed, it was attributable chiefly to the nature of the general ore supply, the increased prices of metals, particularly that of silver, having induced relatively large shipments of ores and mill products high in zinc content, which, if sold at previously prevailing metal prices, would have been far less, if at all, profitable.

"The schedule was devised as a fair means of securing improvement of quality of the general ore supply through elimination of some of the zinc, or placing the burden of cost arising from its presence in undue amount in the furnace charge, upon those who fail to help bring about the desired end. The result of operation under the schedule, during recent months, is manifested by marked improvement in the behavior of the furnaces, by substantially increasing recovery of silver and lead and by decreased cost. No undue margin from increased treatment rates has been derived by the smeltery, and in the opinion of the committee 'the end has justified the means.'

"Finally, the general improvement of conditions warrants the committee's expectation of important concessions in favor of the shippers, upon whom, nevertheless, there still rests the duty of helping themselves. The committee recommends the appointment of a permanent committee on smelter rates."

TORONTO, ONT.—July 5

Many Districts of Northern Ontario have been devastated by extensive bush fires, which at one time threatened to cause much damage in the mining camps, but owing to recent heavy rains the danger has been averted with comparatively small loss. The Boston Creek district and Iroquois Falls sustained much damage. The plants of the Patricia mine and the Cotton property at Boston Creek are reported to have been destroyed, and the Miller Independence, though threatened for some time, escaped. At the Porcupine camp, the West Dome and Davidson mines were in great danger and were saved only after a protracted fight with the flames. In the Timmins neighborhood the Hollinger and other properties were saved by a timely fall of rain.

THE MINING NEWS

Progress of Mining Operations Condensed and Classified for Easy Reference

ARIZONA

Cochise County

PHELPS DODGE (Bisbee)—Copper production for June from all branches 8,415,335 lb. (May 8,355,900), U. S. properties producing 6,253,335, Mexican 1,735,000, and custom ore 427,000.

Maricopa County

RED ROVER (Phoenix) — Company plans to build own power line to connect with line of Arizona Light & Power Co., being built from Fossil Creek plant to Phoenix.

Pinal County

SOUTH RAY COPPER (Kelvin)—Unwatering completed to 500 level. Old timbering needs repairs before sampling can be completed. Crosscutting into walls shows copper orebodies not located by former owners. No. 2 shaft will be unwatered in July. W. B. Duvoll in charge.

RAY BROKEN HILLS (Ray)—Tunnel will be driven another 200 ft. Flow of water now approximately 100 gal. per min.

POLAND COPPER (Ray)—Lateral development on 200 level being continued, and shaft will be sunk additional 200 ft. About fifteen men now employed.

U. S. VANADIUM (Kelvin)—More men working in lower tunnel, from which crosscuts are being driven north and south. Drifting on diabase-limestone contact in lower tunnel shows 5 ft. of well-mineralized vein.

Santa Cruz County

BLUE NOSE (Nogales)—John Hoy, of Harshaw, has sold Blue Nose group to Lyman syndicate, of Jerome. Property formerly big producer of high-grade silver ores, but has been idle since 1881. New owners have installed compressor and hoist and begun sinking new shaft.

HARDSHELL (Harshaw) — Twenty-five men now at work on property. New shaft being sunk at rate of 5 ft. a shift.

ARKANSAS

Marion County

LONNIE BOY (Rush)—Will start erection of small concentrator soon. Five thousand tons zinc ore developed.

MATTIE MAY (Rush)—Work on new mill be resumed at once.

MOONEY-BLAIZER (Rush) — Mooney and Blaizer, owners of ten-acre tract adjoining Philadelphia mine, are developing two zinc orebodies on tract.

CALIFORNIA

Amador County

ARGONAUT (Jackson)—Mill now running to capacity and work progressing on same scale as before fire.

Calaveras County

KEYSTONE (Railroad Flat)—Operations will be resumed under management of Joe King. Shaft now being unwatered.

SHEEPRANCH (Sheepranch)—Preliminary work by Golden Gate Exploration Co. practically complete, and expectations are that mill will be started early in July.

El Dorado County

MANZANITA (Kelsey)—Recently bought by E. V. Fessier. Has been sold to Morovitch-Dryden-Morganson Co., of Seattle.

Nevada County

H. H. NOBLE mineral rights within limits of Nevada City were bid in by David Wildin.

Placer County

MAMMOTH SPRING (Dutch Flat)—Work resumed after usual winter shutdown. Compressor installed to speed work.

GEORGIA HILL DEEP GRAVEL (Yankee Jim)—After consolidating small holdings Croftors has started development by running 1,000-ft. tunnel.

Shasta County

UNITED STATES (Kennett)—Only development work being carried on at Mammoth mine. Company's operations in Mexico continued without interruption in first half of 1919, according to official report. Average tonnage produced and milled about 68,000 per month for first half year. Expected to increase to 80,000 tons in July. Company's coal mines operating full time, with reduced forces.

Sierra County

MARIPOSA (Alleghany)—Electric hoist installed in main tunnel. Ready to begin sinking 500-ft. shaft.

Siskiyou County

LANKY BOB (Salmon River District)—Purchased by J. Tenny, of Seattle, who is arranging to install compressor and drills.

Tuolumne County

ANGELS DEEP (Angels)—On completion of headframe, sinking and crosscutting will be resumed.

SONORA (Sonora)—Property bonded to Blake and Solinsky, of San Francisco. Work to start within thirty days.

COLORADO

Boulder County

VICTORIA MINES (Boulder)—W. S. Garland, of Brockton, Mass., president, and directors re-elected. To increase force and purchase more machinery for development campaign. Mine showing large bodies of high-grade silver ore. Last carlot shipped weighed 27,658 lb., settled for at 102 oz. per ton.

Ouray County

VERNON MINING (Ironton)—Entire plant in Gray Copper Gulch, near Ironton, destroyed by fire on June 26. No insurance. Will be rebuilt. Manager, A. G. de Golyer, Ironton. President, W. L. Fleming, 50 Broad St., New York. Plant shut down recently, with two watchmen in charge. Probable cause of fire spontaneous combustion. Plant included 150-ton concentrator with Marcy mill and flotation equipment, bunk house, boarding house, shaft, and compressor house. Plans for work this year may be carried out through driving new crosscut lower down gulch.

San Juan County

SUNNYSIDE M. & M. (Eureka)—To begin rebuilding bunk house, compressor house and other necessary buildings, preparatory to resuming active work. Will erect steel frame buildings. Will deepen Washington shaft to connect with Terry tunnel at Midway and erect buildings at Midway.

Summit County

SILVER DISCOVERY made by Charles Godfrey and partners on exposed bedrock of Mekka placer east of Breckenridge. Ground leased from owner, M. G. Evans, Denver.

TONOPAH PLACERS (Breckenridge)—Operating three dredges full time, one each in Blue River, upper Swan Valley, and in French Gulch.

WASHINGTON (Breckenridge)—Placer in Illinois Gulch first to start washing gravel this season in Breckenridge district. Under lease to James T. Burney. J. H. Bills in charge.

Teller County

CRESSON (Cripple Creek) — Dechene and Kearns have reached objective in shaft on Maggie, striking flat three-foot vein at 40-ft. Erecting ore bins.

FREE COINAGE CONSOLIDATED (Cripple Creek)—Wilson vein cut by diamond drill at depth of 550 ft. from Pinto mine workings adjoining Wilson on west. Bennett and Gunn, lessees, now crosscutting to vein from 800 level of Lee shaft, of Isabella Mines Co. adjoining Wilson on north.

IDAHO

Shoshone County

RICHMOND (Adair, Mont.) — Winze from lower tunnel down 200 ft. and crosscut being run to vein, which should soon be reached. Ore oxidized copper above, but crosscut is finding stringers of sulphide ore.

SHERMAN (Burke) — Final payment made for property formerly known as Union, total amount being $150,000. Union owned chiefly by estates of late John A. Finch and A. B. Campbell. Sherman Lead Company, purchasers, controlled by Days. Deep tunnel being run expected to develop large lead-silver orebody. Ore found in two tunnels above. In addition to exploring Sherman this lower tunnel is expected to be permanent outlet for Tamarack & Custer adjoining, also controlled by Days.

CARBONATE HILL (Mullan)—Crosscut from shaft at 400 level finding some ore, but main vein thought not yet reached. Expect to prospect ground with diamond drill. Good showing of lead and zinc ore above.

NATIONAL (Mullan)—Company shipped sixteen carloads of concentrates in June averaging 15 per cent copper and 40 oz. silver. This is one car more than May shipments, making record month. Important development work being done on 600 and 800 levels, above working tunnel, which is expected to show ore of better grade.

KANSAS

Joplin District

EARLY BIRD (Baxter Springs)—Installing additional jig. Will need rolls, elevator pulleys, belting, shafting. Plant at Treece, Kan. Cleve Bird, superintendent.

UNION METAL MINES (Waco, Mo.)—Erecting new mill. Will need equipment. P. B. Butler, general manager.

MICHIGAN

Copper District

SENECA (Calumet)—Actual drifting on lode began July 1. Shaft below 1,800 ft. Additional surveys of possible mill sites made on Lake Superior shore on area held under option.

QUINCY (Hancock)—New hoist for No. 2 plant beginning to arrive. Drum will be 30 x 30 ft. Capacity for depth will be greater than that of any other one-rope hoist, easily caring for continuous hoist of 14,000 ft. Present plant hauling from 8,200 ft.

ISLE ROYALE (Houghton)—Production limited to three shafts, Nos. 4, 5 and 7. June tonnage about 42,000. Five drill parties working in newer openings. North of No. 7 shaft, drifts over to No. 6 are holed through to seventh level. To south all drifts from surface down to sixth level have been driven for 1,200 ft. and then stopped, as that is point midway to location of proposed No. 8 shaft.

Gogebic Range

ASHLAND (Ironwood)—Mining operations ceased some time ago, all available ore having been removed, but exploratory work is being carried on with small force on lower levels.

NEWPORT (Ironwood)—Diamond drill operating on surface north of Woodbury shaft and east of old north vein workings. As at other properties considerable attention being paid to horizons 500 ft. to 800 ft. north of foot wall. Wrecking of "D" engine house about completed. Boiler house abandoned last year because ground was sinking, and now several other buildings are affected. Entire surface plant is south of foot wall, where no settlement of ground would be expected.

Menominee Range

AT CRYSTAL FALLS McKinney Steel Co. shipping from Odgers and Dunn mines. All ore in stock at Odgers to be loaded. M. A. Hanna Co. shipping from Carpenter and Monongahela properties.

CARPENTER (Crystal Falls) — Four men reported killed in last issue were caught by a cave-in. Accident occurred just above bottom level, and over 1,000 tons of rock had to be removed before bodies could be recovered.

MUNRO (Iron Mountain) — Operation started for season. Open-pit property. Hoose Construction Co. has contract to do loading in pit.

PEWABIC (Iron Mountain) — Dismantling of entire surface plant about completed. Steel headframe sent to Iron River; most of other equipment sent to other ranges. For many years mine was steady producer of low-phosphorus ores.

IRON RIVER DISTRICT shipments increasing. Most mines operating. Tully inactive, but will ship.

SPIES (Iron River)—Mine closed down. Most ore in stock to be shipped.

MUNROE (Norway)—Shipping of ore begun. Mine now operated as open pit. Mining done by Hoose & Person Construction Co. under contract.

MINNESOTA

Mesabi Range

DRAPER (Calumet) — New open-pit property of John A. Savage Co. has made initial shipment to modern washing plant, recently completed.

AGNEW (Hibbing)—Wisconsin Steel Co. property has reopened and taken on 100 men. One of deepest pits on range and has produced 2,000,000 tons by steam shovel. Present depth necessitates milling and scramming with cable hoist.

RUSSELL (Keewatin)—New prospect of Pickands Mather Co. adjoining Bennett mine of same company being drilled by E. J. Longyear Co.

LA RUE (Nashwauk)—Carlson Exploration Co. operating two drills on supplementary exploration of open-pit orebody for M. A. Hanna & Co.

Vermilion Range

McDONALD (Winton) — New property operated by Chippewa Iron Co. developed to stage where it will probably ship 50,000 tons this season. Shaft bottomed at depth of 345 ft. and levels partly developed at 100, 200 and 309 ft. Royalty 60c. per ton for first five years, thereafter 62½c. Minimum tonnage 20,000 for first year and increasing 10,000 per year until 60,000 tons per year becomes permanent minimum. President, E. B. Corcoran; vice-president and general manager, F. W. Farnsworth; treasurer, J. L. Corcoran; and secretary, A. W. Ballard, all of Cincinnati, Ohio.

MISSOURI

Joplin District

ALLEGHENY WESTERN (Waco)—Moving old Adams mill from Tuckahoe to Waco. Will need steam engine, boilers, rock drills, and tables. W. S. Marquis, general superintendent.

ORANGE (Webb City)—Enlarging all departments of plant. Will need crushers, rolls, hoist, compressor. H. H. Wallower, superintendent.

MONTANA

Park County

JARDINE GOLD (Jardine)—Operating 23 patented claims six miles from Gardiner, Mont. Has started Huntington test mill on gold ore after having been shut down during winter. Remodeling forty-stamp mill built in 1903 by former operators. Will use stamps, amalgamation, tube mills, callow tanks, Janney classifiers, and James concentrators. Present company is reorganization. Property in litigation for ten years. Title perfected in 1917. During 1918 this mine produced $52,000 worth of tungsten ore. Extensive development work done, including 21 crosscut tunnels, with large amount of raises and drifts, showing an extensive commercial vein system. Property has excellent hydro-electric plant, compressor, machine shop and other equipment.

Silver Bow County

ANACONDA (Butte)—Mining operations at 55 per cent capacity; development at about 75 per cent. Scarcity of water near Anaconda, Mont., has resulted in compelling curtailment of concentration of custom ores at Washoe mill. Production for June 10,530,000 lb. of copper, as compared with 13,500,000 in May and 13,750,000 in April.

BUTTE-BULLWHACKER (Butte) — Mining and development will be resumed when it is assured labor troubles will not interrupt. Property being cleaned up.

BUTTE COPPER & ZINC (Butte) — Showing of high-grade silver-lead ore continues east on 1,000 level. Production being increased.

BUTTE-DULUTH (Butte)—Property being placed in condition for resumption of operations. Good ore showing disclosed in winze.

BUTTE & PLUTUS (Butte)—Sinking continues at Plutus shaft. Two feet of ore on 100 level of Mapleton claim.

BUTTE & RAMSDELL (Butte)—Crosscutting and drifting on 300 level on fissures leased from Davis-Daly. Ore showing strong, particularly in the Lizzie vein. Expected to resume shipments as soon as East Butte plant can care for ore.

BUTTE & SUPERIOR (Butte)—Ore showing east on lower levels continues good, with large tonnage indicated. Production being increased in consequence of rising spelter prices and resumption of treatment of zinc concentrates by Anaconda company.

DAVIS-DALY (Butte)—Sinking of Colorado shaft from 2,500 to 2,700 level already progressed quarter way. Average of all smeltery shipments during May was 10.1 per cent copper and 8 oz. silver. Operating less than 50 per cent capacity. Net earnings for June approximately $45,000.

EAST BUTTE (Butte)—Operations being maintained at 75 per cent of capacity, 30 per cent of Pittsmont smeltery output being contributed by Davis-Daly ores.

NORTH BUTTE (Butte) — Production being slightly increased from 25 per cent of normal. Development program pushed at capacity. Ambitious exploration campaign mapped out. Promising ore development reported on 600 level of Speculator.

TUOLUMNE (Butte)—Station cutting on 1,000 level nearly completed. Estimated vein will be reached with 700 ft. of crosscut. Shaft now more than 50 ft. below the 1,000 level and will be sunk to 1,200.

NEVADA

Esmeralda County

CORNFORTH MINE, in Bellehelen district, taken over by Pacific States M. & M. Co., which is capitalized at $1,500,000, par value of stock $1. President, T. T. Cornforth; vice-president and general manager, Warren A. Haggott; secretary-treasurer, Ben Gill. Other two directors Charles S. Sprague and J. B. Wainwright. Home office in Goldfield, with Charles S. Sprague resident agent. Executive committee comprises Cornforth, Haggott and Sprague.

GOLDFIELD DEVELOPMENT (Goldfield)—Planned to start stamps about Aug. 1, when repairs and alterations are expected to be complete. Will start on Red Top ore.

NEW YORK

Jefferson County

BASIC PRODUCTS CORPORATION (Natural Bridge)—Preparing plans for inclined railway, ore hoist, and housing to be constructed at Natural Bridge, at estimated cost $12,000 to $15,000. New York office, 233 Broadway.

TEXAS

Brazoria County

GULF PRODUCTION (West Columbia) —Eyers No. 2 well came in June 24. Well is 2,800 ft. deep.

Eastland County

GUGGENHEIM INTERESTS have purchased holdings of Gates Oil Co., of Ardmore, Okla. Land consists of W. T. Barker lease, six miles northwest of Ranger, of 67 acres; 40 acres of Hilly tract and 223 acres of Hawkins tract, near Desdemona, all in Eastland County, and 2,200 acres in Oklahoma. Barker lease, midway between Perkins gusher and Danley well of Prairie Co. Well on tract now 3,320 ft. deep.

Grimes County

BIG BEND OIL & GAS (Navasota)—Entire property changed hands recently; will drill soon. New officers: C. C. Camp, president; E. F. Blackshear, secretary; Ward Templeman, treasurer; B. F. Reeves, manager.

Liberty County

BIG FOUR OIL (Hull)—No. 4 Hannicker well came in June 26, flowing from 1,550 ft. but soon sanded, and has not been brought in again.

Orange County

SHIPBUILDERS' OIL & GAS (Orange) —Building new rig over Rio Bravo well, a producer brought in six years ago, intending to rewash it in effort to make it flow again.

ORANGE OIL (Orange)—Has won race against time, after delay in starting to drill, thereby saving lease and $1,000 forfeit.

Victoria County

GOLDEN EAGLE (Victoria) — Drilling on Golden Eagle No. 1 well, near Victoria, started June 22.

Wodd County

WIXON OIL & GAS (Bryan)—Organized locally; capitalization, $75,000. Rig ordered, and drilling will be done about fifteen miles northeast of Bryan on Navasota River. Officers: O. L. Tabor, president; S. E. Hallan, vice-president and general manager.

UTAH

Beaver County

UTAH SULPHUR (Morrissey)—Plant, consisting of two retorts, turning out 40-50 tons of sulphur daily, to be enlarged by addition of three new retorts, each three times as large as those now in use, making possible treatment of 1,080 tons of ore daily.

Juab County

TINTIC SHIPMENTS first half 1919 amounted to 3,630 cars, including four cars bullion, as compared with 4,416 cars first half of 1918 and 5,363 cars the first half of 1917. Thirty shippers thus far, as compared with 40 last year. Tonnage around 181,000 tons, valued at $5,700,000. June shipments, 489 cars, as compared with 686 cars in June last year. Shipments held down by labor shortage early in year and later by low price of metals and high costs.

CENTENNIAL-EUREKA (Eureka) — Damage to shaft timbers occurring when steel was being hoisted caused short closedown for repairs.

CENTRAL STANDARD (Eureka) — Equipment being placed in readiness for starting work. Shaft to be sunk.

PAYMASTER (Eureka) — Contract let for sinking shaft from 200 level to depth of 1,000 ft.

TINTIC DRAIN TUNNEL (Eureka)— In 3,000 ft. in formation requiring no timbering. Will connect with Iron Blossom and, starting from there, probably unwater large mining area.

TINTIC MILLING (Silver City)—Car of bullion amounting to 32 tons shipped, expected to bring about $90,000. Runs high in silver.

UNCLE SAM (Silver City)—To be opened at depth from 1,900 level of Colorado Consolidated shaft, formerly Beck tunnel. Will give depth of several thousand feet below old workings productive in past.

Summit County

PARK CITY SHIPMENTS first half of 1919 amounted to 237,368 tons, valued at $2,500,000, according to camp estimates and weekly shipments. This is compared with 57,000 tons first half of 1918. Production for June, 1918, was 7,750 tons, that for June, 1919, was 165 tons, owing to strike, only ore shipped coming from Naildriver.

SILVER KING CONSOLIDATED (Park City)—Work resumed on Spiro tunnel, now in 10,000 ft. and being driven to develop Thaynes Canyon section and connect with California-Comstock ground. Expected also to start work in old workings on opposite side of hill, where producing ground is open to 1,800 level.

Salt Lake County

SILVER SHIELD (Bingham) — Old workings retimbered and shaft in condition for work.

CARDIFF (Salt Lake City)—Shipped 350 to 450 tons week ended June 28. Ore silver-lead of good grade. Fifty-five men working. Drifting started on 800 level, with view to opening neighboring Kennebec.

CANADA

British Columbia

GRANBY CONSOLIDATED (Vancouver, B. C.)—Production for May was 1,848,803 lb. copper; 41,532 oz. silver; and 2,307 oz. gold. For April, 1,333,523 lb. copper; 29,692 oz. silver; and 1,595 oz. gold. For March, 667,142 lb. copper; 17,723 oz. silver; and 1,283 oz. gold.

Ontario

TEMISKAMING (Cobalt)—Oreshoot 2 in. wide carrying high-grade encountered at 575-ft. depth.

ALLIED GOLD MINES (Boston Creek) —Extension of Miller Independence vein cut by diamond drilling.

GREENE-KIRKLAND (Kirkland Lake) —Exploration program planned. Small mining plant will be installed.

KIRKLAND COMBINE (Kirkland Lake) —Work started on group of claims adjoining Sylvanite. Andrew Grierson, manager.

LAKE SHORE (Kirkland Lake)—Production during May amounted to $42,136, from the treatment of 1,750 tons of ore, being an average recovery of $24.08 per ton.

ONTARIO-KIRKLAND (Kirkland Lake) —Officially stated that mill with capacity of 100 tons daily will be installed.

ASSOCIATED GOLDFIELDS (Larder Lake)—One thousand feet of diamond drilling done on Dr. Reddick property. Two diamond drills at work on Kerr-Addison group adjoining.

LUCKY CROSS (Swastika)—Taken over by New York interests and renamed Marigold.

HERRICK (West Shining Tree)—Contract let for 5,000 ft. of diamond drilling. Vein about 25 ft. wide traced for nearly 1,000 ft. Shaft down 50 ft.

THE MARKET REPORT

Daily and Weekly Metal and Mineral Prices, Metal Market Conditions, Average Monthly Prices, Stock Quotations

Silver and Sterling Exchange

July	Sterling Exchange	Silver New York, Cents	Silver London, Pence	July	Sterling Exchange	Silver New York, Cents	Silver London, Pence
3	4.5200	1.07¼	53⅜	7	4.4900	1.07⅜	53¾
4	.....	.....	53½	8	4.4800	1.07	53 11/16
5	4.5000	1.07⅝	53 9/16	9	4.4763	1.06	53 3/16

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

Daily Prices of Metals in New York

July	Copper Electrolytic	Tin Spot	Lead N. Y.	Lead St. L.	Zinc St. L.
3	19.10@19.30	68	5.30@5.40	5.15@ 5.17½	7.00@7.05
4	.....	....	.....	....	.....
5	.....	....	.....	....	.....
7	19.60@19.85	68	5.35@5.40	5.17½@5.20	7.10@ 7.12½
8	19.85	68	5.40	5.17½@5.20	7⅛
9	19.85	68	5.40	5.17½@5.20	7⅛

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other special shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 35c. per 100 lb above St. Louis. Tin is quoted on the basis of American tin, 99 per cent grade.

London

July	Copper Standard Spot	Copper Standard 3 M.	Copper Electrolytic	Tin Spot	Tin 3 M.	Lead Spot	Lead 3 M.	Zinc Spot	Zinc 3 M
3	91½	92½	92	241	238½	22⅝	22⅞	39¾	40
4	91¾	92¾	95	243½	241¼	22½	22¾	38¾	40
5	...	...	...	...	...	...	...	...	...
7	94	95	96	248½	245¼	22¾	23	40	40½
8	95¼	96¼	97	247½	244¾	23	23⅛	40⅛	40⅝
9	97½	98½	100	250	248	23½	23⅞	41⅝	42¼

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb.

Metal Markets

New York—July 9, 1919

There was great activity in copper during the week, but zinc and lead, while both strong, were only moderately active.

Saturday, following July 4th, was kept generally as a holiday. Although some of the offices were open, substantially no business was transacted.

Transatlantic freight rates remained unchanged, but there is an easier tendency. Rate from San Francisco to Hongkong and Kobe continues at $14.

The sharp decline in sterling exchange puts some recent export sales in quite a different light.

Copper

Copper—A large business was done on Thursday at advancing prices, which led producers to make a further raise when the market reopened on Monday, on which day they began at 19¾c. delivered, and ended with 20c. delivered. On Tuesday very large business was done at 20c. delivered, corresponding to 19.85c. net cash, New York. Business was done at the same price on Wednesday, and it was clear that speculative interests would be willing to pay even more if producers were disposed to sell to them. The demand from consumers on this day was much lighter than on the previous day.

The aggregate sales per week amounted to a fairly large total. Wire-drawers were the principal buyers, but there were some important transactions with brass-makers, especially on Tuesday. The demand for cakes was relatively light. A fair amount of export business was done, this including sales to England and also to Japan, which was still a buyer.

The recent Japanese buying, which has been regarded as mysterious, is believed to have a substantial foundation. Japan has bought copper and lead not only in this market, but also in Australia, and has been inquiring in London. Speaking generally, the Orient is the most prosperous part of the world at the present time, and manufacturing costs in Japan are considered to give that country a great advantage over both Europe and America. Moreover, the Japanese activity in the metal markets has been based partly on munition requirements.

The labor situation in Butte is uncertain. Exorbitant demands on the companies have been made, which cannot be granted. Negotiations have been going on without any settlement being reached. Some of the men have failed to go to work, leaving the companies short-handed. Whatever be the outcome, the uneasiness will have a considerable effect upon production.

The sales of copper by American producers in June were very large, though not quite so large as in May. The Government copper has been practically liquidated, although under the terms of the agreement it was contemplated that fifteen months might be required to accomplish it.

Copper Sheets—The base price of copper sheets is 29c. per lb. Market fair, and improving. Copper wire is quoted at 23@23½c. in carload lots, f.o.b. mill. Market strong.

Tin

Tin—The market remained unchanged at 70c. for high-grade tin and 68c. for 99 per cent grade, the situation being practically in the hands of the two smelters, inasmuch as consumers possessing surplus stocks have evinced no anxiety to resell. The business by brokers has been mainly in tin for shipment. Straits for July shipment and English for July shipment were sold at 52c. and 51½c. respectively, in the early part of the week. In the latter part, sales were made at ¼c. higher.

Lead

Lead—Some of the principal producers are in a very strong position, but others have not yet sold as much as they would like to, and their offerings hold the market back. This naturally produces a situation where special brands may command a premium, which is distinctly the case with chemical hard lead. In the Ohio valley and at other points in the Middle West lead fetches prices above either the New York or St. Louis parity. Lead manufacturers report continuance of good business, especially in white lead. In

its statistical position lead is no doubt stronger than either copper or zinc, but the market lags, nevertheless.

Zinc

Zinc—After the halt last week, the advance was resumed, but there did not seem to be any great enthusiasm about it. There was again some buying for export, but the situation in respect to sterling exchange makes it uncertain what sellers are going to realize on such business.

There was some fair business done in high-grade zinc at moderate premiums over the price for common zinc.

Zinc Sheets—The quoted price of zinc sheets is $10 per 100 pounds.

Other Metals

Aluminum—Virgin metal quoted at 33c. per lb. Market quiet.

Antimony—The market was strong at unchanged prices, viz., 8⅞@8½c. for spot.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.10 per lb. for wholesale lots—500 lb. and over.

Cadmium—Quoted at $1.50 per lb. in lots of 500 pounds. For lots under 200 pounds, $1.75 per lb.

Nickel—Ingot, 40c.; shot, 43c.; electrolytic, 45c. per pound

Quicksilver—New York price advanced to $107, at which figure the market closed strong. San Francisco telegraphed $95, firm.

Silver and Platinum

Silver—After advancing to 53⅜d., declined in London under American sales at 53⅛d. Exchange on London continues to be drooping, with the future uncertain.

Mexican dollars at New York: July 3, 82½; July 4, holiday; July 5, 82⅜; July 7, 82⅜; July 8, 82¼; July 9, 81⅞.

Platinum—In strong demand. We quote ingot at $105@$107.50.

Palladium—Rather easier. We quote $118@$120.

Zinc and Lead Ore Markets

Joplin, Mo., July 5—Zinc blende, per ton, high, $48; basis 60 per cent zinc, premium, $46; Prime Western, $45; sludge and flotation, $42.50@$40; calamine, basis 40 per cent zinc, $28@$25. Average settling prices: Blende, $43.04; calamine, $26.32; all zinc ores, $42.10.

Lead, high, $62.90; basis 80 per cent lead, $60; average settling price, all grades of lead, $60.76 per ton.

Shipments the week: Blende, 7,240; calamine, 499; lead, 1,342 tons. Value, all ores the week, $451,390.

Report is that not a movement is being made today by any of the mines in the district, so many miners declaring their intentions of not returning to work until Monday, at the close of work the evening of July 3, that no other course was open to producers, many of whom would have resumed today. Pumping operations save the situation from an appearance of abandonment. With the prohibition enforcement coming the first of the week, and the observance of two days' holiday at the end, the production in output will closely approach 50 per cent.

Platteville, Wis., July 5—Blende, basis 60 per cent zinc, $47 base for premium grade and $44.50 base for high-lead or Prime Western grade. Lead ore, basis 80 per cent lead, $60 per ton. Shipments reported for the week are 1,947 tons blende, 233 tons galena, and 232 tons sulphur ore. For the year to date the totals are 52,171 tons blende, 2,844 tons galena, and 7,376 tons sulphur ore. During the week 3,396 tons blende was shipped to separating plants.

Other Ores

Chrome Ore—High-grade ore is reported offered at 50c. per unit f.o.b. California.

Molybdenum Ore—Quoted nominally at 75@85c.

Tungsten Ore—Chinese ore was sold at $6.75@$7 per unit. A lot of high-grade scheelite for export was sold at $10. There is rather more inquiry for this tungsten ore.

Other Minerals

Pyrites—Spanish pyrites is quoted at 18c. per unit for furnace ore, c.i.f., New York or other Atlantic port, and 18½c. at Gulf ports. Market slow and unsettled; hand-to-mouth buying.

Nitrate—Price is quoted at $3.10 to $3.25, carload lots, for immediate shipment in this country. Little change developed during the week, although considerable business was reported done after the removal of Government control of price, owing to drop in quotations. Practically all supplies are now being obtained from Government allotments to importers, only a small quantity reported being brought in from South America.

Iron Trade Review

New York—July 9

June sales of pig iron in the case of some furnaces equaled the total for several preceding months, and now in a limited way there is pig iron buying for delivery in 1920, including some malleable in the Central West, says *The Iron Age*. But many foundries have yet to cover for the fourth quarter of this year. Enough furnaces are going in to make the market uneven in their efforts to get backlog orders. Some cuts are heard of each week, but are generally reported as lapses which did not break the market.

Some Southern furnaces that were weak sellers are asking $1 a ton more, the recent heavy bookings of their Northern competitors having turned some inquiry southward. Eastern Pennsylvania still reports concessions on foundry iron, and standard low-phosphorus iron is available at $35. Less than the full price was asked on a round lot of basic wanted by a large northern Ohio steel foundry.

A British inquiry for 20,000 tons of basic iron gives a fair prospect of business. Sweden and Holland and other countries, which see little early chance of getting pig iron from Germany, are now inquiring here.

Pittsburgh—July 8

The improvement in the iron and steel market is so steady that it is quite uneventful, with no clouds on the business horizon. In no particular quarter is there any burst of buying enthusiasm, but orders for steel products are flowing in more and more freely, and mills are enabled to operate at higher rates from week to week, the present rate of steel-ingot production being nearly if not quite 70 per cent of capacity. Steel-ingot capacity increased by 40 per cent from 1914 to the present time, and steel-finishing capacity, except in plates, increased much less. The result is that some finishing departments are able to operate at close to capacity, even though the ingot-production rate is not over about 70 per cent.

By far the busiest branch of the finished-steel trade is the lap-weld departments of the pipe mills, which are running at capacity, some of them being booked up for practically the remainder of the year, almost entirely by reason of the heavy demand for oil-country goods. This phase of activity is reflected in the plate market, which is extremely dull, except for the demand for plates for oil tanks. The automobile trade continues to be a heavy buyer of all the steel products it uses, orders for sheets and cold-drawn steel being especially conspicuous. Dwelling-house construction is increasing throughout the country, and particularly in the Pittsburgh district, where trades disputes, except that with the painters, are settled, and contractors are in position to bid on the large volume of work that has been waiting. In bridge and fabricated steel work generally there is not much activity, although conditions in this respect are improving.

Steel prices are much firmer and price cutting is exceptional. It still occurs in plates, and though not absent from the sheet trade it is no longer conspicuous. In pipe and wire products there is not the semblance of shading, and there is little if any in bars.

Some of the independent pipe and wire mills seem to wish to advance prices, but they know that the Steel Corporation is opposed, and it is doubtful whether any advances will be attempted. It is asserted that the mill position in these lines is such that advances could easily be held, but the effect in the future would be problematical.

Tin-plate production has increased rather sharply, the industry now operating at near to capacity, but this burst in activity is attributed chiefly to demands of the fruit and vegetable crops in California, which prove much larger than anticipated, and all the tin plate for California must be got out by the

end of this month, so that August may see light operations again. Export tinplate demand, however, is increasing steadily, and even in May the exports were 14,000 gross tons, against an average during the war of about 19,000 tons a month, and only about 5,000 tons a month before the war.

Pig Iron—Several important furnace interests are now practically sold up to the end of the year, but they are not oversold, as they usually consider it desirable to be, to take care of the postponements that customers frequently request. Buying is of much smaller proportions than in June, but there is still a fair flow of business. Practically all irregularities in the market have disappeared. Though there are many idle furnaces, it is improbable that there will be any disturbance to the market by their attempting to come in until a fresh buying movement develops. We quote the Valley market firm as follows: Bessemer, $27.95; basic, $25.75; foundry, $26.75; forge, $25.75, f.o.b. furnace, with $1.40 freight to Pittsburgh.

Steel—Demand for sheet bars has increased sharply, as both the sheet and the tin-plate industries are running at higher rates. The Carnegie Steel Co. finds it necessary to start the Columbus works, a small high-rent consumption, there being little contracting. Billets are dull, but with prices firmly held, and there is no demand for slabs. We quote: Billets, $38.50; sheet bars and small billets, $42; slabs, $41; rods, $52.

Ferroalloys

Ferromanganese—Competition between the domestic and British producers is now in sight. The recent sales of domestic at $110 delivered, when British was held at $121, c.i.f., or about $125 delivered, stirred things when British was held at $121, c.i.f., and domestic producers state they will meet this price. The presumption is that both parties would shade the figure. There is no demand at the moment. Spiegeleisen is nominally quotable at $30@$33 delivered for 18 per cent.

Coke

Coke—The spot furnace coke market was firm all last week, at $4.25 as minimum, but there had been three scares as to prospective curtailment in production, first a celebration in anticipation of prohibition; second, the national holiday, and, third, the Fayette County celebration of the return of men from service with the colors, a four-day affair to be concluded tomorrow. The spot market is now expected to ease off, particularly as idle ovens seem to be coming in faster than consumption is increasing. Many furnaces, however, are disposed to accumulate stocks against the winter, and this should absorb any bargains that may be forced on the market. With increased labor efficiency it is understood that the majority of operations show a profit on $4 coke.

MONTHLY AVERAGE PRICES OF METALS

Silver

	New York			London		
	1917	1918	1919	1917	1918	1919
Jan.	75.630	88.702	101.125	36.682	44.356	48.438
Feb.	77.585	85.716	101.125	37.742	42.792	48.027
Mar.	73.861	88.082	101.125	36.410	43.620	48.171
April	73.875	95.346	101.125	36.963	47.215	48.886
May	74.745	99.505	107.135	37.940	48.980	52.104
June	76.971	99.500	110.430	39.065	48.875	53.896
July	79.010	99.625		40.110	48.813	
Aug.	85.407	100.292		43.418	49.077	
Sept.	100.740	101.125		50.920	49.500	
Oct.	87.332	101.125		44.324	49.500	
Nov.	85.891	101.125		43.584	48.969	
Dec.	85.960	101.125		43.052	48.492	
Year	81.417	96.772		40.851	47.516	

New York quotations cents per ounce troy, 999 fine London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London			
	Electrolytic		Standard		Electrolytic	
	1918	1919	1918	1919	1918	1919
Jan.	23.500	(a)	110.000	92.238	125.000	106.619
Feb.	23.500	16.763	110.000	78.700	125.000	95.700
Mar.	23.500	14.856	110.000	76.821	125.000	82.071
April	23.500	15.246	110.000	77.300	125.000	82.200
May	23.500	15.864	110.000	77.767	125.000	81.227
June	23.500	17.610	110.000	83.062	125.000	85.900
July	25.904		119.913		134.913	
Aug.	26.000		122.000		137.000	
Sept.	26.000		122.000		137.000	
Oct.	26.000		122.000		137.000	
Nov.	26.000		122.000		137.000	
Dec.	(a)		118.447		133.167	
Year	24.628		115.530		130.507	

(a) No Market.

Tin

	New York		London	
	1918	1919	1918	1919
January	85.500	67.702	293.227	248.557
February	92.000	66.801	311.525	223.963
March	(a)	67.934	318.875	236.843
April	(a)	72.500	329.905	225.275
May	(a)	72.500	364.217	234.398
June	(a)	71.240	331.925	238.263
July	(a)		360.347	
August	(a)		380.900	
September	(a)		343.905	
October	(a)		335.543	
November	(a)		323.550	
December	(a)		267.736	
Av. year	(a)		330.138	

(a) No average computed.

Lead

	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	6.782	5.432	6.684	5.316	29.00	37.227
February	6.973	5.057	6.899	4.784	29.00	28.675
March	7.201	5.226	7.091	4.992	29.00	27.952
April	6.772	4.982	6.701	4.722	29.00	24.888
May	6.818	5.018	6.704	4.773	29.00	23.852
June	7.611	5.340	7.511	5.070	29.00	22.544
July	8.033		7.750		29.00	
August	8.050		7.750		29.00	
September	8.050		7.750		29.00	
October	8.050		7.750		29.00	
November	8.050		7.750		31.20	
December	6.564		6.324		40.00	
Year	7.413		7.222		30.10	

Zinc

	New York		St. Louis		London	
	1918	1919	1918	1919	1918	1919
January	7.836	7.272	7.661	7.922	54.000	56.045
February	7.814	6.623	7.639	6.273	54.000	46.150
March	7.461	6.500	7.286	6.150	54.000	38.500
April	6.890	6.465	6.715	6.114	54.000	36.118
May	7.314	6.429	7.114	6.079	54.000	35.477
June	8.021	6.901	7.791	6.551	54.000	36.763
July	8.688		8.338		54.000	
August	8.985		8.635		54.000	
September	9.442		9.092		54.000	
October	8.801		8.451		54.000	
November	8.491		8.141		54.100	
December	8.163		7.813		56.050	
Year	8.159		7.890		54.180	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pittsburgh

	Bessemer‡		Basic‡		No. 2 Foundry	
	1918	1919	1918	1919	1918	1919
January	$37.25	$33.60	$33.95	$31.40	$33.95	$32.40
February	37.25	33.60	33.95	31.40	33.95	32.40
March	37.25	32.54	33.95	31.40	33.95	29.12
April	36.15	29.35	32.95	27.15	33.95	28.15
May	36.20	29.35	33.00	27.15	34.00	28.15
June	36.36	29.35	33.16	27.15	34.16	28.15
July	36.60		33.40		34.40	
August	36.60		33.40		34.40	
September	36.60		33.40		34.40	
October	36.60		34.40		35.40	
November	36.60		34.40		35.40	
December	36.60		34.40		35.40	
Year	$36.67		$33.70		$34.45	

‡ As reported by W. P. Snyder & Co.

STOCK QUOTATIONS

N. Y. Exch.†	July 8
Alaska Gold M.	8
Alaska Juneau	2½
Am.Sm.&Ref.,com.	80½
Am.Sm. & Ref., pf.	108½
Am.Sm.Sec., pf., A	93
Am. Zinc	26
Am. Zinc, pf.	62
Anaconda	74½
Batopilas Min.	1½
Bethlehem Steel	95
Butte & Superior	36½
Butte Cop. & Zinc	13½
Cerro de Pasco	64
Chile Cop.	28
Chino	47½
Colo. Fuel & Iron	51
Crucible Steel	116
Crucible Steel, pf.	105
Dome Mines	14½
Federal M.&S.	16
Federal M. & S., pf.	43
Great Nor., ore ctf.	49½
Greene Cananea	44½
Gulf States Steel	71½
Homestake	85
Inspiration Con.	66½
International Nickel	31½
Kennecott	40½
Lackawanna Steel	91½
Mexican Petrol.	193½
Miami Copper	28½
Nat'l Lead, com.	82
National Lead, pf.	110
Nev. Consol.	19½
Ontario Min.	8
Ray Con.	25½
Republic I.&S.,com.	88½
Republic I.&S., pf.	104½
St. Joseph Lead	14½
Sloss-Sheffield	74½
Tennessee C. & C.	13½
U. S. Steel, com.	113½
U. S. Steel, pf.	116½
Utah Copper	92½
Va. Iron C. & C.	68
Worthington Pump	83½

Boston Curb*	July 8
Boston Ely	1½
Boston & Mont.	.84
Butte & Lon'n Dev.	17
Calaveras	1½
Chief Con.	3½
Contact	‡.05
Cortez	.12
Crown Reserve	.35
Crystal Cop.	11
Eagle & Blue Bell	2½
First Nat. Cop.	‡1
Gadsden Cop.	‡3½
Houghton Copper	1
Intermountain	‡.05
Iron Blossom	.30
Iron Cap	10½
Majestic	.25
Mexican Metals	.14
Mines of America	‡.05
Mojave Tungsten	.15
Nat. Zinc & Lead	.09
Nevada-Douglas	.14
New Baltic	1½
Oneco	.75
Pacific Mines	‡.35
Rex Cons.	‡.12
Yukon Gold	.87

San Fran.*	July 8
Alta	.08
Andes	.15
Best & Belcher	.10
Caledonia	.12
Challenge Con.	‡.03
Confidence	‡.25
Con. Virginia	1.50
Gould & Curry	.04
Hale & Norcross	.05
Jacket-Cr. Pt.	.14
Mexican	.39
Occidental	‡.40
Ophir	1.00
Overman	‡.10
Savage	.11
Sierra Nevada	.05
Union Con.	.14
Utah Con.	‡.04
Belmont	3.50
Jim Butler	.31
MacNamara	.43
Midway	.33
Mont.-Tonopah	.15
North Star	.08
Rescue Eula	.17
West End Con.	1.85
Atlanta	.03
Booth	.08
Comb. Frac.	‡.04
Florence	.50
Jumbo Extension	.10
Kewanas	.03
Nevada Hills	.04
Nevada Packard	.23
Round Mountain	.37
Sliver Pick	.07
White Caps	.16

Colo. Springs*	July 8
Cresson Con.	3⅛
Doctor Jack Pot	.03
Elkton Con.	.04½
El Paso	.15
Gold Sovereign	‡.02
Golden Cycle	1.69
Granite	.11½
Isabella	.04½
Mary McKinney	.07
Portland	.97
United Gold M.	.16½
Vindicator	.37

Boston Exch.†	July 8
Adventure	1½
Ahmeek	82½
Algomah	‡.80
Allouez	44½
Ariz. Com.	14½
Arnold	‡.90
Bingham Mines	‡9½
Bonanza	‡.20
Butte-Balaklava	‡.38
Calumet & Ariz.	71½
Calumet & Hecla	437
Carson Hill	‡7½
Centennial	‡.6
Copper Range	53½
Daly West	‡2½
Davis-Daly	8½
East Butte	16
Franklin	4½
Granby	‡67
Hancock	‡6
Hedley	‡12
Helvetia	4½
Indiana	‡1½
Isle Royale	37½
Keweenaw	‡1½
Lake	5½
La Salle	‡3½
Mason Valley	‡3½
Mass	7
Mayflower	11½
Michigan	‡6½
Mohawk	72½
New Arcadian	‡4
New Cornelia	24
New Idria	‡9
Nipissing	11½
North Butte	13½
North Lake	‡1½
Ojibway	2½
Old Dominion	43
Osceola	‡57½
Quincy	73
St. Mary's M. L.	‡59
Santa Fe	‡.35
Seneca	‡24
Shannon	3½
Shattuck-Ariz.	‡15½
So. Lake	2½
So. Utah	‡.23
Superior	‡8
Superior & Bost.	3½
Trinity	‡3½
Tuolumne	1½
U. S. Smelting	69½
U. S. Smelting, pf.	49½
Utah Apex	‡3
Utah Con.	10½
Utah Metal	2⅜
Victoria	‡3½
Winona	1½
Wolverine	24

N. Y. Curb†	July 8
Alaska B. C. Met.	1⅛
Alaska Mines	‡½
Big Ledge	‡½
Butte & N. Y.	‡½
Butte Detroit	‡.03
Caledonia	.40
Calumet & Jerome	‡⅛
Can. Cop. Corpn.	1½
Cashboy	.08½
Con. Ariz. Sm.	‡½
Con. Coppermines	‡½
El Salvador	‡½
Goldfield Con.	17
Goldfield Merger	‡.04
Hecla Min.	5½
Howe Sound	‡½
Louisiana	‡½
Magma	50
Marsh	09½
McKinley-Dar-Sa.	.63
Milford	‡.75
Mother Lode	‡.43
Nixon Nevada	‡.23
Ohio Cop.	‡⅛
Rawley	‡½
Ray Hercules	2½
Richmond	‡.50
Rochester Mines	‡.19
So. Am G. & P.	11½
Standard S. L.	1
Stewart	.23
Success	.04½
Tonopah	‡3½
Tonopah Divide	8
Tonopah Ex.	2½
Tribullion	‡.25
Troy Arizona	‡.10
United Eastern	4⅛
United Verde Ext.	.40½
United Zinc	‡.25
Utica Mines	‡.08

Toronto*	July 8
Adanac	.15
Bailey	.03
Beaver Con.	.42
Conlagas	2.37½
Hargraves	.02
Kerr Lake	5.75
La Rose	.37½
Lake Shore	.87½
Min. Corp. of Can.	1.25
Peterson Lake	.12
Teck-Hughes	.17
Temiskaming	.35
Trethewey	.35
Wettlaufer-Lor.	.03
Davidson	‡.68
Dome Exten.	.35
Dome Lake	.18
Hollinger	6.50
McIntyre	1.62½
Newray	.12½
Porcu. Crown	.28
Vipond	.20
West Dome	.12

*Bid prices. †Closing prices. ‡Last quotations.